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CHASE VI SEARCH OPERATIONS

FEBRUARY 1968

NAVAL OCEANOGRAPHIC OFFICE
WASHINGTON, D. C. 20390

ABSTRACT

On 10 August 1967, the Navy intentionally scuttled ROBERT LOUIS STEVENSON, (a World War II Liberty ship) near the Aleutian Islands. The hulk, loaded with 2000 tons of obsolete explosives, was set to explode at a depth of 4000 feet simulating a low-yield underwater nuclear explosion. Seismic signal data from this explosion would assist in the United States' program to develop the capability for detecting clandestine underwater nuclear explosions. Failing to sink immediately as planned, the ship drifted into shallow water and sank without exploding.

Moving quickly but with a well planned operation, the Navy proceeded to resolve the fourth major marine emergency in recent years. After searching the area for 6 days, NAVOCEANO's deep-towed magnetometer located the hulk on 11 September. NAVOCEANO personnel obtained underwater camera pictures identifying STEVENSON by using BENT's narrow-beam sonar to navigate and hold over the magnetometer contact. Aircraft from Adak, Alaska, dropped twenty-four 2000-pound bombs on the hulk but failed to detonate the cargo. Several of these bombs exploded close enough to the hulk to provide overpressure for the necessary duration to detonate the hydrostatic fuses aboard STEVENSON. The Navy notified the public of the exact location of CHASE VI and terminated the operation on the basis that the hulk could not be accidentally detonated.

F. M. DAUGHERTY, JR.

Exploratory Oceanography Division

JOSEPH A. CHEESEMAN

Operations Office

JERRY C. CARROLL

Magnetics Division

FOREWORD

Locating and obtaining high-quality photographs of the STEVENSON's hulk in only eight days vividly illustrates the advances made in deep-water search techniques since the THRESHER tragedy in 1963. Although the plan of action developed and implemented here was highly successful and should serve as a guide for conducting deep-water search operations, the Navy must continue developing better tools and techniques for handling future emergencies, especially those occurring far-from-shore and in deeper water.

L. E. DeCamp

L. E. DeCAMP
Captain, U. S. Navy
Commander

ACKNOWLEDGEMENTS

There were many people who contributed to making the search operation a success. We wish to thank Messrs. Chester Buchanan and Jervis Genarri of the Naval Research Laboratory for their assistance and for the loan of a cable and supplies. We wish to thank Dr. Stanley Murphy and his team from the University of Washington's Applied Physics Laboratory for responding to the requirement for an underwater positioning system. BENT's crew did an excellent job in helping us conduct the operation on a continuous basis and responding to meet all of our requirements. Personnel from NAVOCEANO who conducted the search operations aboard BENT included:

F. M. Daugherty, Jr.	Project leader and senior NAVOCEANO representative
Frank A. Anderson	Chief Scientist
Jerry C. Carroll	Leader - Magnetometer search
Donald J. Findlay	Navigational Supervisor
Elmer B. Diehlman	Navigator
Charles Sharpe	Project Engineer
Hawley W. Thomas	In charge of camera systems
David Handschumacher	Magnetometer Search team
Michael Lowery	Magnetometer Search team
Martin W. Lacey	Mechanical expert who handled cable termination and helped modify the deep-towed magnetometer vehicle
Clarence E. Pierce, Jr.	Navigator
William B. Young, Jr.	Navigator
Harold E. Grimm	Navigator
Robert Coulter	Navigator
Gerald K. Grover	Navigator

Joseuke S. Toda	Navigator
Vance G. Sprague, Jr.	Watchstander/narrow-beam sonar and vehicle height
Joseph F. Koskije	Watchstander/narrow-beam sonar and vehicle height
Clement J. Acker	Watchstander/narrow-beam sonar and vehicle height
Frank Wilcox	Watchstander/narrow-beam sonar and vehicle height
Michael L. Lopes	Watchstander/narrow-beam sonar and vehicle height
William H. Scheu	Watchstander/Wire angles
Brian B. Hill	Watchstander/Wire angles
Larry M. Reynolds	Watchstander/Wire angles
Thomas G. Hammons	Texas Instruments Representative
David E. Harmod	U. S. Weather Bureau
Allan N. Kynett	U. S. Weather Bureau
Victor E. Yorka	Programmer

Joseph A. Cheeseman acted as project leader in Kodiak, Alaska, and adviser to Admiral White.

USNS SILAS BENT PERSONNEL

Edward C. Savage	Master
Philip J. Rosten	1st Officer
W. W. Youngblood	2nd Officer
Richard Smith	3rd Officer
H. F. Hazelbaker, Jr.	Radio Officer
Arnold J. Harstad	Chief Engineer

Joseph B. Coy, BOSN	Maurice Green, AB
Shirley G. Dobbs, AB	Wayne Bouchey, AB
Gregory A. Slusser, AB	Roger M. Knoebber, OS
Donald L. Horton, AB	Lawrence W. Arvold, OS
Milton Hunter, AB	Richard F. Winters, OS
Angel Oquendo, AB	

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I. INTRODUCTION

On 10 August 1967, the former SS ROBERT LOUIS STEVENSON, a World War II liberty ship loaded with 2,000 tons of explosives, was intentionally scuttled off the Aleutian Islands. The Navy had planned sinking the ship approximately 32 miles off the coast with water-pressure detonators (SUS bombs) designed to explode the cargo at a depth of 4,000 feet, thus creating the largest in a series of underwater blasts for the Advanced Research Projects Agency's nuclear test detection program. For undetermined reasons, STEVENSON took 16 hours longer than expected to sink. She drifted into fog and finally sank about 17 miles offshore in waters less than 3,000 feet deep -- less than needed to detonate the cargo. The resulting emergency was quite unique, and it was feared that a ship passing directly over STEVENSON might supply the additional pressure needed for detonation and possibly destroy both ships.

This report describes the search, subsequent attempts to destroy STEVENSON, and final disposition of the emergency, with emphasis on first locating the hulk with a deep-towed magnetometer system and later positively identifying the hulk with an unusual series of underwater photographs.

II. BACKGROUND

The Navy's CHASE program for the deep-water disposal of deteriorated and defective ammunition came into being in 1963. OPNAVINST 8026.1 dated 12 April 1963 assigned this responsibility to the Naval Ordnance Systems Command, who after determining ordnance is available for disposal, requests a ship hulk from the Military Sea Transportation Service. Commercial contractors usually prepare the hulk for scuttling, and Navy Ammunition Depots at Bangor, Washington, and Earle, New Jersey, load the hulk with obsolete ordnance. Either Navy or commercial tugs tow the loaded hulk to deep-water sites chosen for ordnance disposal.

Previous to the CHASE VI operation described in this report, there were four CHASE events off the United States east coast, and one off the west coast. In a July 1964 east coast CHASE event, the hulk's cargo of explosives accidentally detonated, suggesting that the CHASE program could be performed in close cooperation with the Advanced Research Projects Agency (ARPA) who is responsible for developing a capability to detect clandestine underwater nuclear explosions. As a result, CHASE VI was a joint ARPA-Navy project, with ARPA choosing the site and making plans to use the explosion as a seismic source to record velocity and attenuation data at seismic stations located throughout the United States. The Navy through CINCPACFLT directed the operational aspects of the project, providing the necessary on-site support including air surveillance and surface surveillance at the test site by USCGC CONFIDENCE. COMTHIRTEEN assigned USS TATNUCK (ATA-195) to accompany and assist the tow vessel. Aboard TATNUCK were a scuttling crew from NAD, Bangor, and personnel from the Office of Naval Research contractor (Underwater Systems, Inc., Silver Spring, Md.) who were responsible for making on-site measurements and recording the pressure-time history of the shock wave.

On 24 July 1967, the ex-SS ROBERT LOUIS STEVENSON loaded with 2,000 tons of explosives, departed Bangor, Washington, under tow by the commercial tug STAR CRESCENT. Six MK 59 underwater SUS bombs were packed into open detonator and booster holes of MK 51 mines with C-3 plastic explosives packed around them and set to detonate the cargo at a depth of 4,000 feet. Design tolerance of the SUS bomb is ±10 percent, and detonation of any one of the six bombs would cause complete detonation. No back-up fusing was provided.

Upon arrival at 51°16'N - 178°19'E at 0312Z on 10 August, the scuttling crew opened STEVENSON's sea cocks and cast her adrift to sink. For reasons unknown, the hulk did not sink as scheduled, and was observed to drift to the north and closer to land. Weather conditions deteriorated rapidly, with winds up to 20 knots and visibility decreasing to 300 yards. At 1400Z, the hulk was observed afloat at 51°21.5'N - 178°20'E. At 1720Z, the hulk was observed at 51°23.7'N - 178°21'E in about 500 fathoms of water. Radar contact remained good but the attitude of STEVENSON was unknown. TATNUCK at 1845Z approached the hulk to ascertain its condition, and its investigation at 1932Z revealed STEVENSON on even keel with freeboard of 7 feet forward, 5 feet amidships, and 3 feet aft, but the detonators were inaccessible. TATNUCK lost radar contact at 2240Z and estimated that STEVENSON sank at 51°26'N - 178°18'E. CONFIDENCE confirmed losing radar contact at this time. Detonation did not occur.

III. NAVOCEANO PRELIMINARY ACTION

The Naval Oceanographic Office first received notice of the emergency on Friday, 11 August. Captain Louis E. DeCamp, Commander, Naval Oceanographic Office, after meeting with key personnel to assess the situation, appointed Commander S. E. Applegarth, Director of NAVOCEANO's Operations Office and Mr. A. E. Craig, Deputy Director, Hydrographic Surveys Department, as project officers, directing them to make preparations for a search operation. The project officers immediately diverted USNS SILAS BENT (Photo 1), the Navy's newest deep-water survey ship, to the area. They also started an in-house effort to gather the best possible bathymetric, magnetic, oceanographic, weather, and navigational information of the CHASE VI area, and sent Messrs. J. A. Cheeseman and F. M. Daugherty, Jr. to Kodiak, Alaska, to assist Rear Admiral Donald M. White, Commander, Alaskan Sea Frontier. Admiral White was later designated Commander, Task Force 93 (CTF-93) and given responsibility for disposing of the emergency. Also at this time, Mr. Craig directed our Magnetics Division to start assembling a deep-towed magnetometer system similar to that used in locating the remains of THRESHER in 1963 (Reference 1).

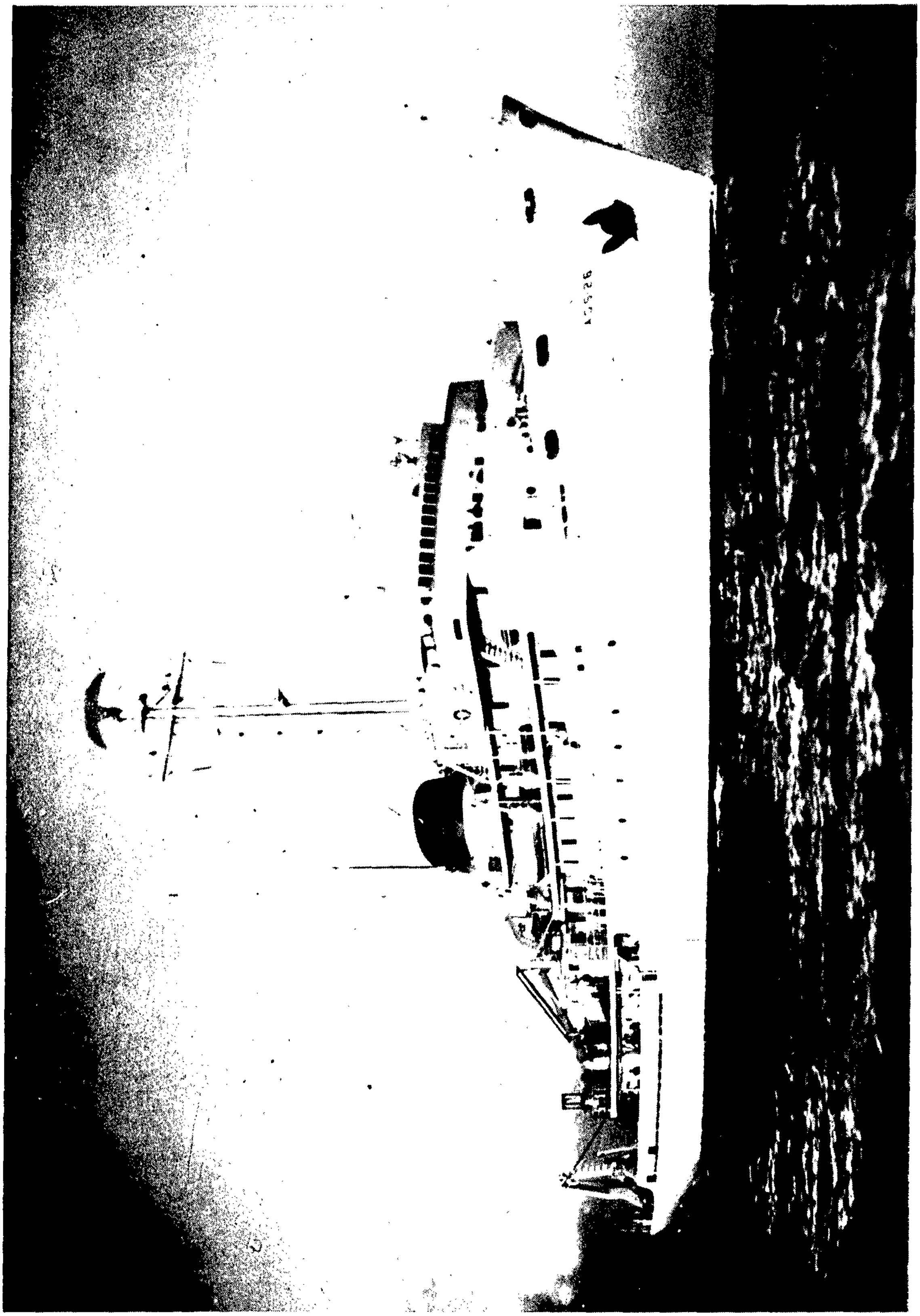


PHOTO 1, USNS SILAS BENT (T-AGS 26)

IV. CTF-93 PLANNING

After arriving in Kodiak on 13 August, Messrs. Cheeseman and Daugherty met with Admiral White, his Chief of Staff Captain Paul A. Tickle, and Commander John Orem, Salvage Officer, COMSERVPAC, an expert in salvage operations. They outlined briefly NAVOCEANO's experience in similar emergencies such as the loss of THRESHER in 1963 and the Mediterranean Salvage Operations of 1966, explaining that NAVOCEANO was ready to provide similar assistance or take any other action CTF-93 deemed necessary. CTF-93 decided that the first order of business was to study and evaluate all available information (including the instrumentation and equipment aboard BENT and otherwise available in the area, the various estimates of STEVENSON's sink position, the area's bathymetry, and whether the loran-C nets in the area would provide the needed navigational accuracy for a systematic search) before deciding on a definite course of action. NAVOCEANO's representatives assisted in these evaluations, and after replotting the available navigational information on STEVENSON and constructing a three-dimensional model of the area's sea floor (Photos 2 and 3), a two-mile square centered on 51°26'N and 178°18'E (TATNUCK's last radar contact) was selected as the priority search area, although aircraft using JULIE/JEZEBEL equipment had obtained contacts in water more than 4,000 feet deep. CTF-93 decided that the equipment, ships, and navigational facilities available in the area were sufficient at least for the initial search operations, but requested NAVOCEANO to continue readying the deep-towed magnetometer system, and to consider procuring a multi-ship precision navigational system such as Decca Hi-Fix if a more extensive search became necessary.

By 16 August a two-phase plan of action had been developed with Captain Alfred F. Betzel, Commander, Service Squadron Seven, assigned as the On-Scene-Commander (CTG-93.2). Phase I of this plan proposed that bombs be dropped from aircraft on the suspected datums in an effort to obtain a sympathetic explosion

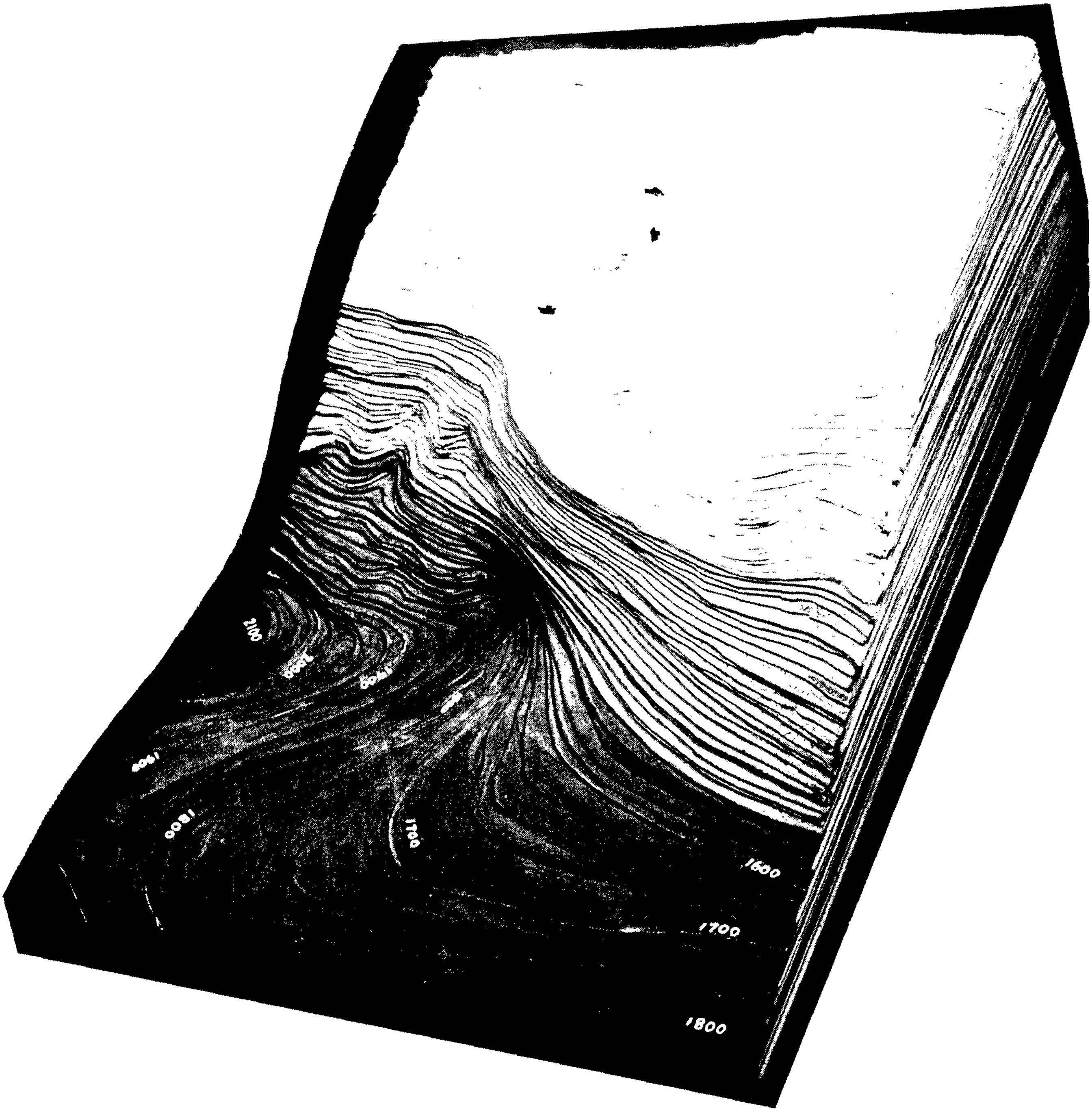


PHOTO 2, THREE DIMENSIONAL CONTOUR MODEL OF SEARCH AREA

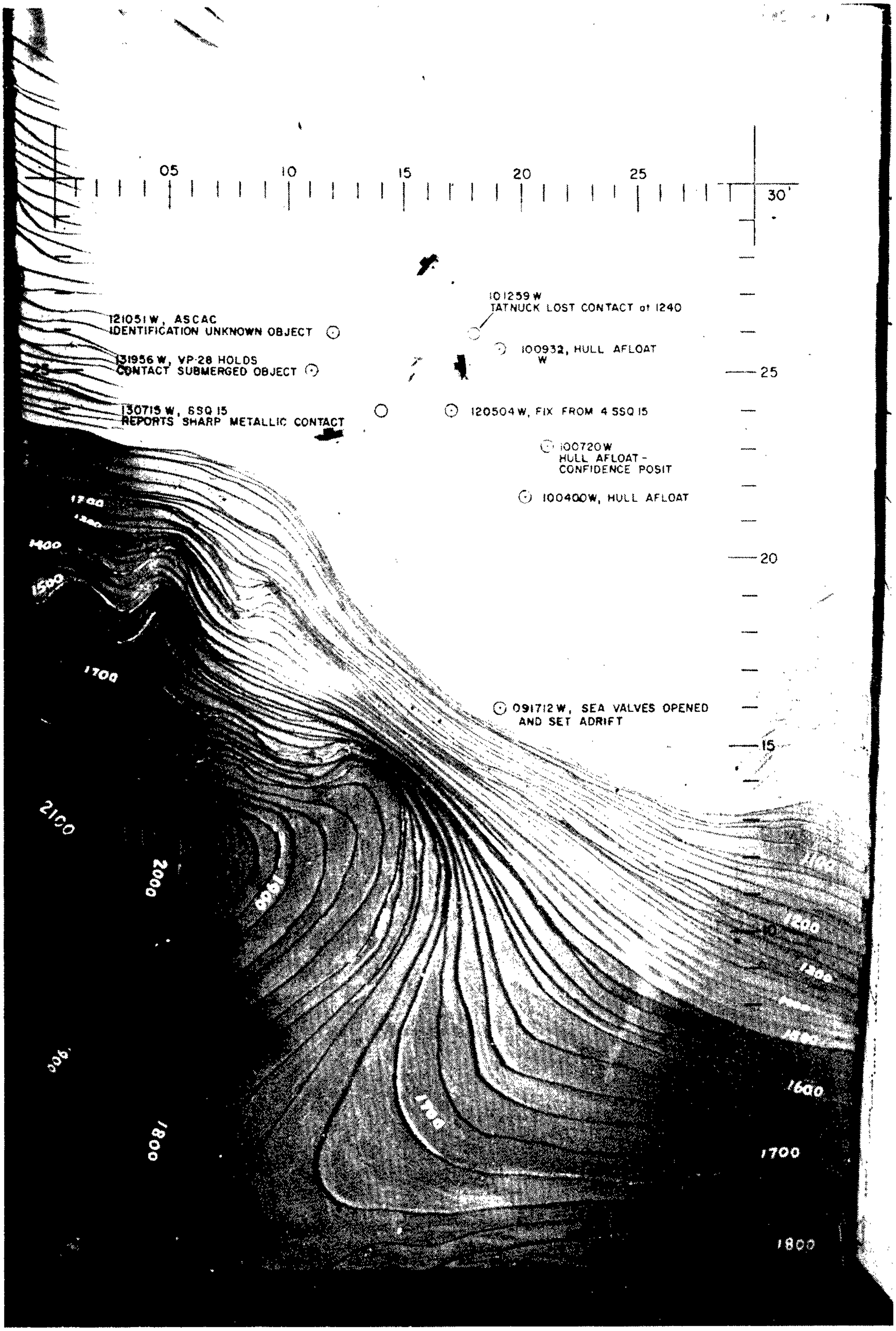


PHOTO 3, THREE DIMENSIONAL CONTOUR MODEL OF SEARCH AREA WITH SINK DATA OVERLAY of the ship or create overpressure to actuate the SUS bomb fuses. Unsuccessful bombing would provide a basis for removing restrictions on surface search operations, and Phase II of the plan including the location, identification, and disposition of the emergency could then proceed as follows:

(1) BENT would conduct a preliminary survey to refine existing charts and provide a better understanding of the environment.

(2) ASW sonar, ship-mounted sonar, a deep-towed magnetometer system, and/or side-looking sonar would be used to locate the hulk.

(3) After locating the hulk, underwater cameras and possibly television would be used for positive identification.

(4) The hulk would be disposed of by placing charges directly on STEVENSON by using controlled underwater vehicles such as CURV or SORD, by lowering charges down moored lines, or by bombing from aircraft. The method used would depend on the depth, condition, and attitude of the hulk.

Task Force 93 would consider its mission successfully concluded:

(1) If the hulk were located in waters deeper than 4,500 feet

(2) If the hulk were found to be destroyed and its cargo dispersed

(3) If successful detonation of the cargo were accomplished, or

(4) If the hulk were no longer considered a threat to surface navigation.

V. ON-SCENE PREPARATIONS FOR SEARCH OPERATIONS

Phase I attempts to detonate STEVENSON were unsuccessful. During this phase, BENT conducted conventional bathymetric and magnetic surveys outside the area and planted two navigational marker buoys to aid the alignment of aircraft making bomb runs over the hulk's suspected position. After unsuccessful bomb runs, CTG-93.2 decided to proceed with the Phase II plan of operations.

NAVOCEANO had completed the assembling of a deep-towed magnetometer system by 21 August, and immediately shipped it to Adak. A three-man magnetometer search team headed by Mr. Jerry C. Carroll arrived in Kodiak on 24 August and briefed CTF-93 on the magnetometer's capabilities and use. The system (Photo 4), similar to the one used successfully in the THRESHER search, consists of a proton precession magnetometer sensor placed on the end of a plastic boom and extended 10 feet behind a specially constructed aluminum vehicle with 10,000 feet of cable connecting it to ship-board equipment modified with noise cancelling circuits. Lead weights and a pinger, similar to that used with underwater camera systems, were added to the sensor vehicle. As Mr. Carroll anticipated some difficulty in positioning the towed sensor relative to the ship by measuring wire angles and cable lengths, he had made arrangements with Dr. Stanley Murphy of the University of Washington's Applied Physics Laboratory to obtain their acoustical tracking system which would give accuracies of 50 to 100 feet rather than the 300 feet expected by measuring wire angles and cable lengths. However, the APL tracking system was not expected to arrive in Adak until 15 September.

Following this briefing, the magnetometer search team and Mr. Daugherty, who was to serve as CHASE VI project officer aboard BENT, departed Kodiak for Adak on 25 August.

On the afternoon of 26 August, Captain Betzel (CTG-93.2) held a conference aboard BENT to formulate specific plans for implementing Phase II operations. At this conference, it appeared that the group's best chance of success would be a systematic search with the deep-towed magnetometer system. Captain Betzel, with the assistance of CONFIDENCE's personnel, reworked the original sink-position information and developed a new position. The priority search area was re-positioned on a center-line between the "original" and the "revised" sink positions. With good weather, the primary area could be

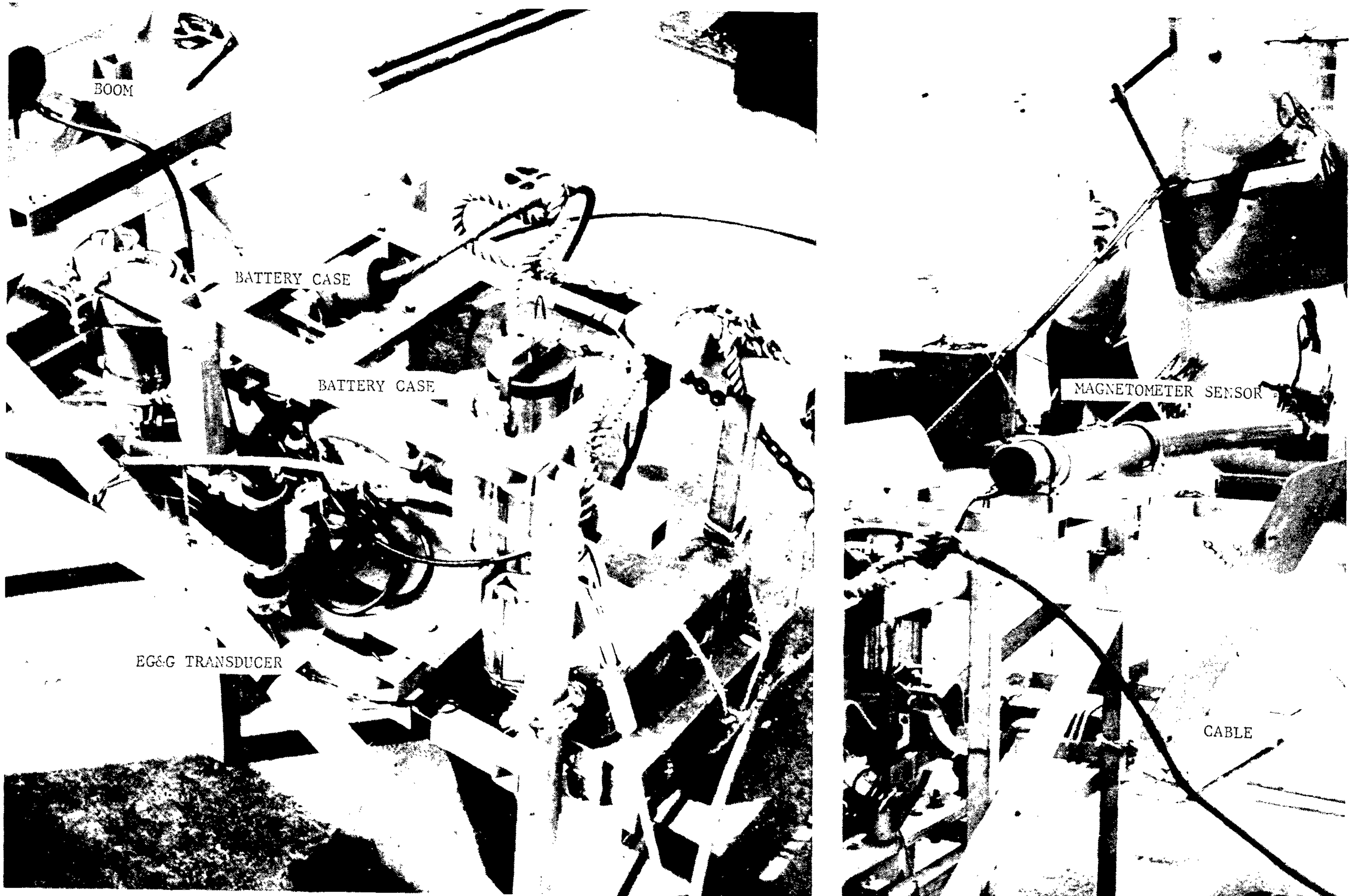


PHOTO 4, MAGNETOMETER VEHICLE

thoroughly searched in two or three days; however, if the search area had to be expanded, coverage might take as much as three weeks. It was decided to tow the system at a height of 125 to 200 feet above the bottom, the height being determined by measuring the time difference between receipt of a direct pulse from the vehicle's pinger and the reflected pulse from the bottom. Once a good magnetic contact was found, an effort would be made to obtain photographs of the contact.

Mr. Frank Anderson, Chief Scientist for the NAVOCEANO detachment aboard BENT, provided the scientists with available information on CHASE VI and outlined their duties and responsibilities. He established watches for the wire angle measurements, the precision graphic recorder, the narrow-beam sonar, the magnetometer system, and the navigation so that the ship would have a 24-hour capability of keeping a real-time plot of both ship and the magnetometer vehicle. Others were assigned to maintain equipment and prepare marker buoys and current meters for installation. Mr. Donald Finlay, Navigation Phase Leader, prepared loran-C charts of the search area at a scale of 1:25,000, and requested the Coast Guard to take special care in the timing and frequency stability operation of the SL3 loran-C chain.

Also at this time, an analysis was made of all the magnetic data collected by BENT's surface-towed magnetometer during its many days of operations around the area of interest. This analysis showed that magnetic anomalies caused by geological sources were not exceptionally large in amplitude and had wavelengths of 3,000 feet or greater, while an anomaly associated with the STEVENSON would be of much shorter wavelength. If the sensor were towed at a height of 200 feet directly above the hulk, STEVENSON would probably show up as a magnetic anomaly of over 800 gammas. It was also noted that the magnetometer records revealed no temporal magnetic disturbances during this period; in fact, no disturbances occurred during the entire operation.

VI. SEARCH OPERATIONS

The magnetometer team completed installation of the deep-towed system by 1 September, and BENT departed for the search area. As some components of the system had not been used since 1963, some difficulties with the system were expected, and this proved to be the case. On the first lowering to a depth of 1,000 feet, leakage in the magnetometer sensor prevented successful operation. This was quickly repaired, and on the second lowering, electrical shorts developed in the cable. As this particular problem had been anticipated, a suitable amplifier designed to remedy the situation had been shipped to Adak with the system, and NAVOCEANO's Mr. Michael Lowry was well prepared to adapt it into the system. The amplifier would prove helpful later in integrating the magnetometer, cameras, and positioning system.

In addition to these problems, towing instability at slow speeds initially limited the system's sweep range to 600 feet. Towing at higher speeds improved stability and increased the range, but caused the vehicle to tow too far behind the ship -- preventing reception of the pinger's sound pulse necessary for positioning the vehicle relative to the bottom. Adding weights to the vehicle and extending the sensor an additional two feet behind the vehicle improved the stability and increased the system's sweep range to 1500 feet.

On 3 and 4 September, while testing and modifying the deep-towed magnetometer system, BENT conducted detailed surface magnetic and bathymetric surveys (Figures 1 and 2) in the operating area. The resulting bathymetric contour chart was used effectively in planning the search and keeping the vehicle off the bottom during operations. Bathymetric slopes in the search area were as great as 25° and the reaction time required to keep the vehicle from striking the bottom limited the tow speed. A tow speed of approximately 1.5 knots was considered optimum; at this speed the system performed well and it was possible to continually monitor the height of the vehicle, minimizing the possibility of its striking bottom.

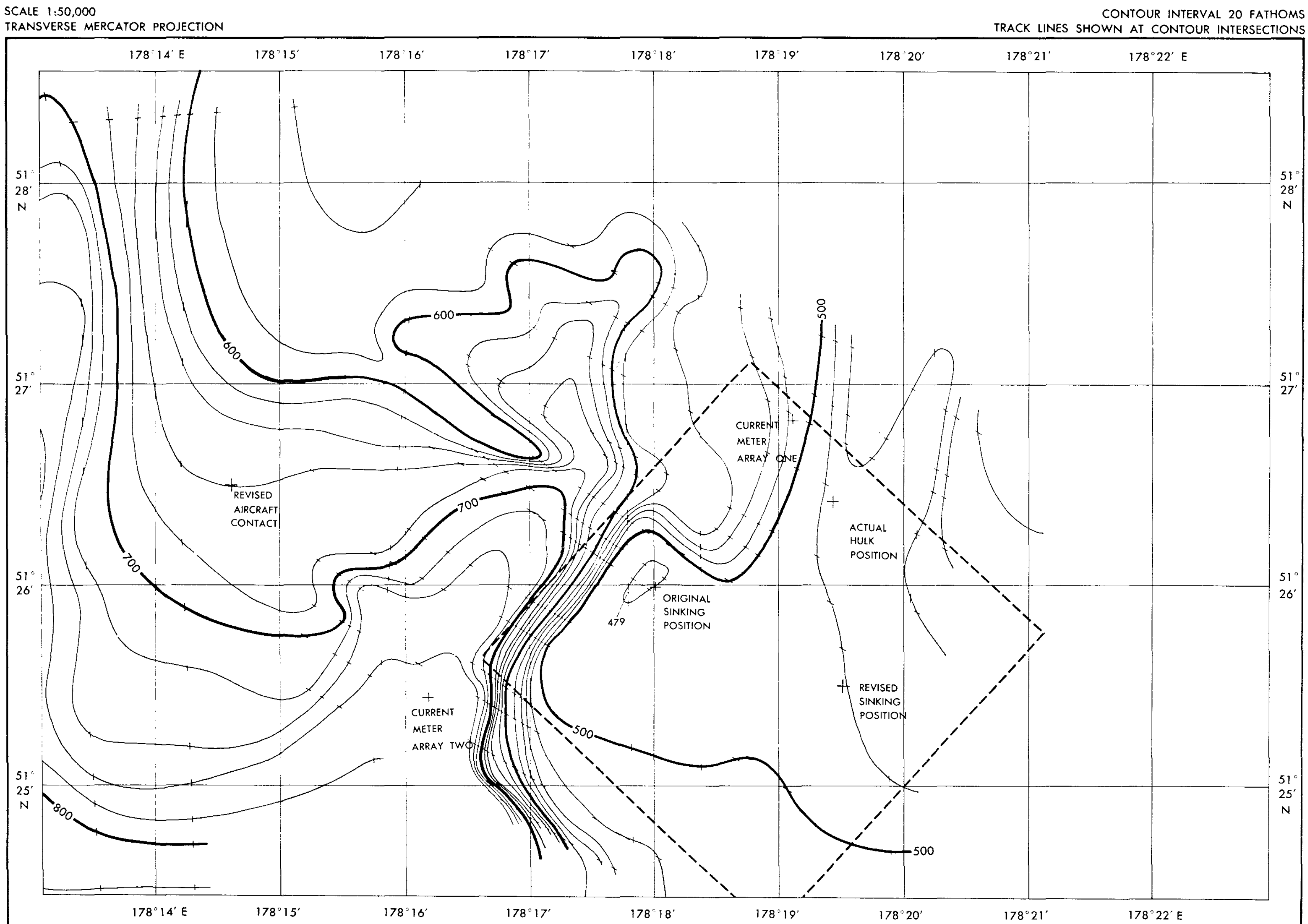


FIGURE 1. BATHYMETRIC CONTOUR CHART OF CHASE VI AREA

SCALE 1:50,000
TRANSVERSE MERCATOR PROJECTION

CONTOUR INTERVAL 10 GAMMAS
TRACK LINES SHOWN AT CONTOUR INTERSECTIONS

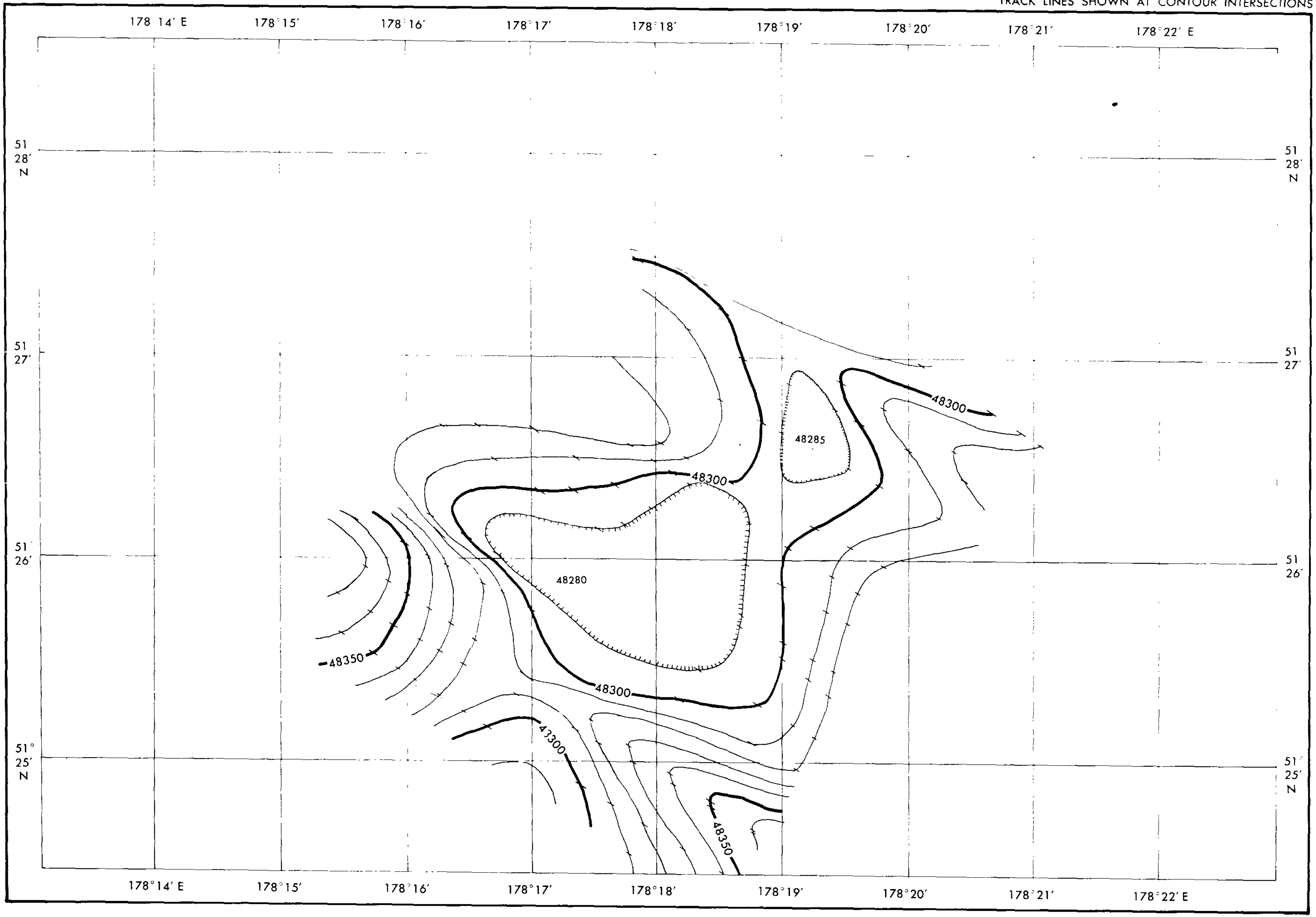


FIGURE 2. MAGNETIC TOTAL INTENSITY CONTOUR CHART OF CHASE VI AREA, OBTAINED WITH SURFACE-TOWED UNIT

By 5 September, the deep-towed magnetometer system, capable of obtaining measurements at 3-second intervals and displaying them both digitally and on an analog recorder, was operational. BENT started its search for the STEVENSON hulk concentrating its search efforts over the two best estimates of the sink position (Figure 1). Search operations were interrupted on 7 September to test the underwater cameras and excellent pictures of the bottom were obtained. Again on 9 September after no magnetic contacts had been made during a thorough investigation of the estimated "sink positions," search operations were halted to plant two current-meter arrays, as a knowledge of the currents would undoubtedly be an aid in determining the best areas to continue investigation.

The first significant magnetic contact was recorded at 0605Z and the second at 0623Z on 10 September. This first contact, a negative anomaly of 160 gammas, was geological in origin and associated with a steep slope in the area. A second contact looked more promising, but a closer investigation indicated that it had been caused by difficulty encountered in keeping the vehicle above the bottom. The third significant magnetic contact was recorded at 0200Z on 11 September, and a check of the bathymetric records revealed that this anomaly was also of geological origin and associated with an extension of the steep slope over which the first contact was recorded.

The CHASE VI area was located on a volcanic archipelago, and as a consequence, there were many magnetic anomalies of geological origin in the area (Figure 3). These anomalies usually have a much longer wavelength than those associated with ships and submarines and are larger in area. Thus, the only anomalies that could possibly be confused with a ship contact were the three listed above. Careful evaluation of the data eliminated these, and no time was wasted in investigating them with cameras or other equipment.

At 1541Z on 11 September, a magnetic anomaly of 1000 to 1500 feet in wavelength with a maximum amplitude of 1440 gammas was detected (Figures 4 and 5). The anomaly was the type expected if the magnetometer sensor passed

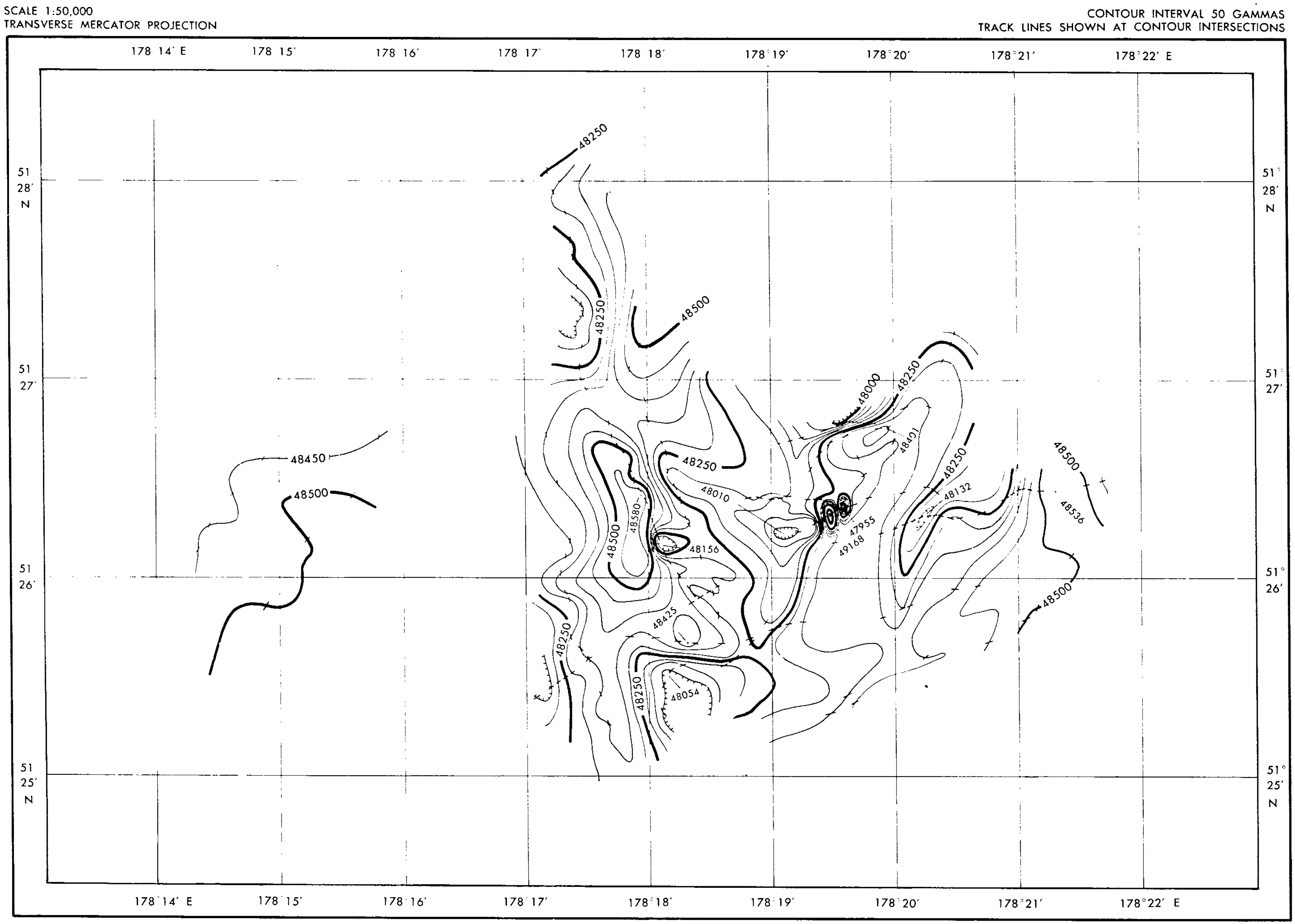


FIGURE 3. MAGNETIC INTENSITY CONTOUR CHART OF CHASE VI AREA, OBTAINED WITH DEEP-TOWED UNIT

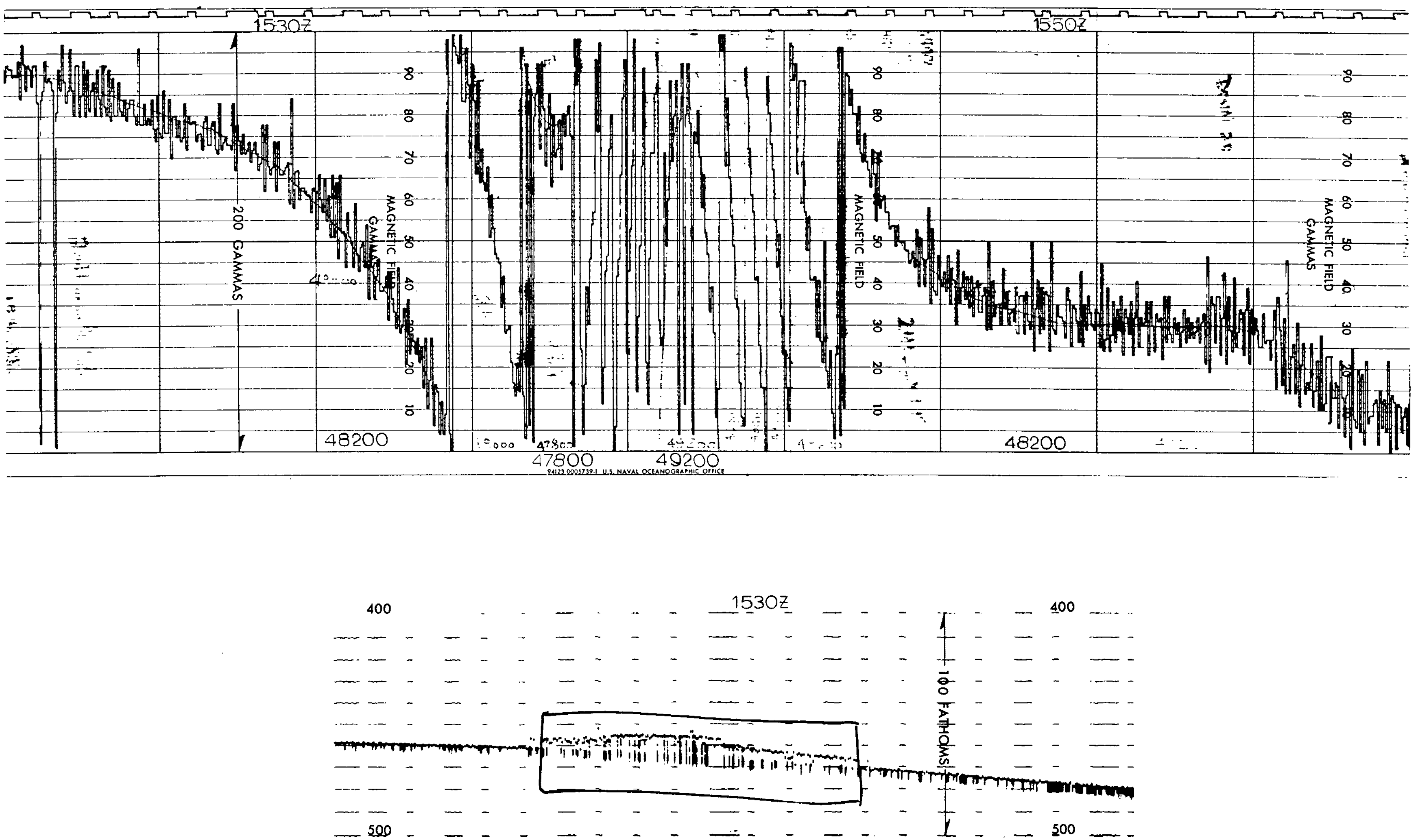


FIGURE 4. MAGNETIC AND SONAR CONTACT OF STEVENSON HULK

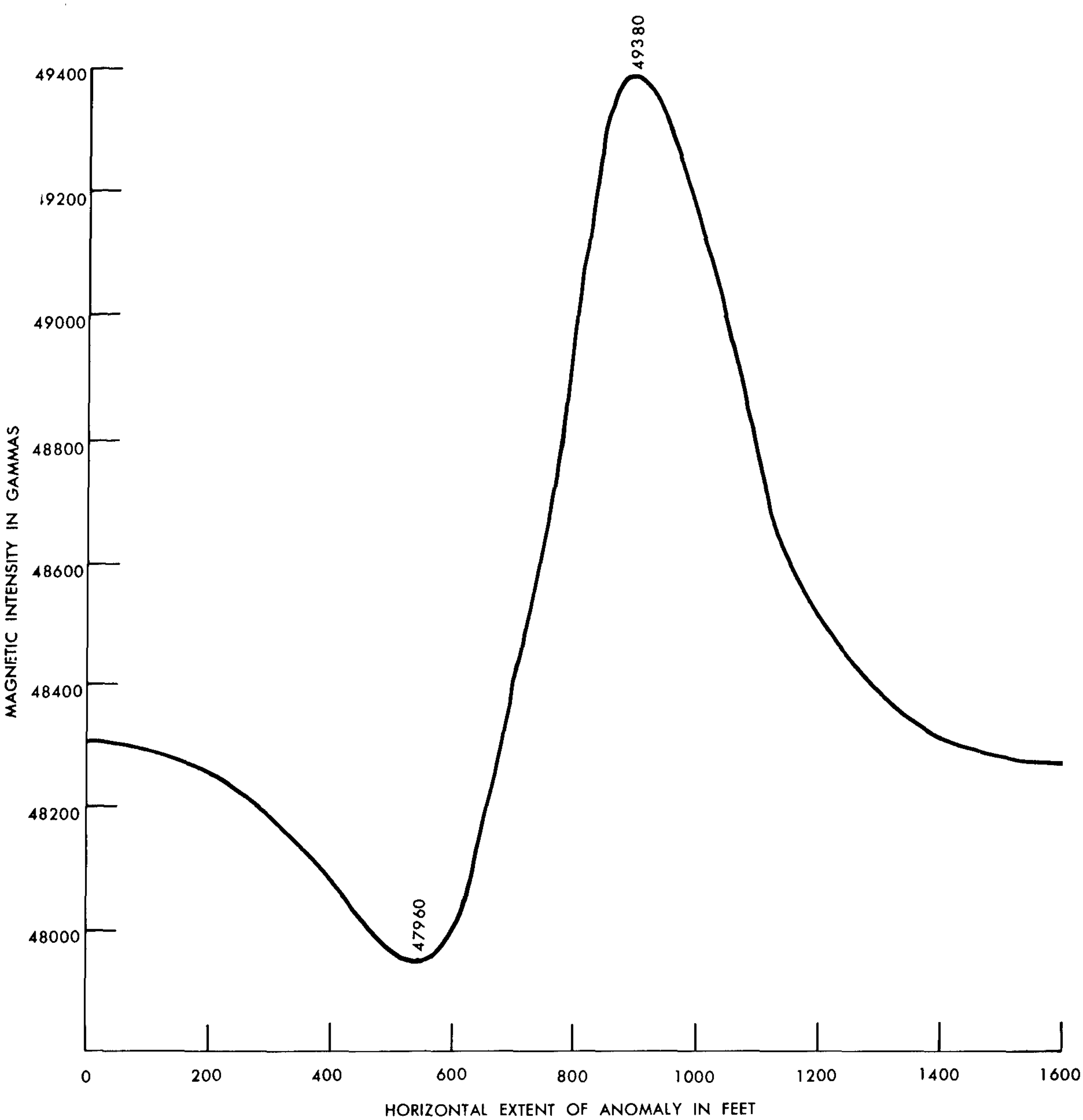


FIGURE 5. PROFILE OF MAGNETIC ANOMALY RECORDED OVER THE STEVENSON HULK

within 100 feet of the STEVENSON hulk. A careful check of the narrow-beam echo sounder records revealed a faint contact of approximately 800 feet in length and 30 feet in height. The cone-width of the echo sounder in 3000 feet of water was calculated to be 150 feet which indicated that the sonar contact could indeed be the ship.

The next objective was to establish the areal extent of the anomaly. If the extent of the contact was limited, then we felt that the ship had been located. Two more sweeps were made near the contact using a north-south track pattern. On each track, the ship and sensor passed to the east of the contact at a distance of 1000 to 1500 feet, and neither a magnetic anomaly nor a bathymetric contact was recorded. These last two tracks, combined with previous recorded tracks, confirmed that the contact was limited to about ship size.

The last sweep was completed at 2250Z on 11 September, and it was necessary to recover the magnetometer vehicle because the life of the batteries used to power the pinger had elapsed. As the seas at this time prevented launching the underwater camera, an effort was started to better define the contact using the narrow-beam sonar equipment. During the following 12 hours, BENT passed over the contact on eight different occasions (Figures 6 and 7). Analysis of the records revealed that the ship was lying in a NE-SW direction and upright.

During this period when the contact was recovered with the narrow-beam system, the ship's speed was kept at less than 2 knots and good results were obtained. Earlier search attempts using the narrow-beam equipment had been made at higher speeds, and the contact was of such limited size the ship could easily be confused with background noise on the bathymetric records.

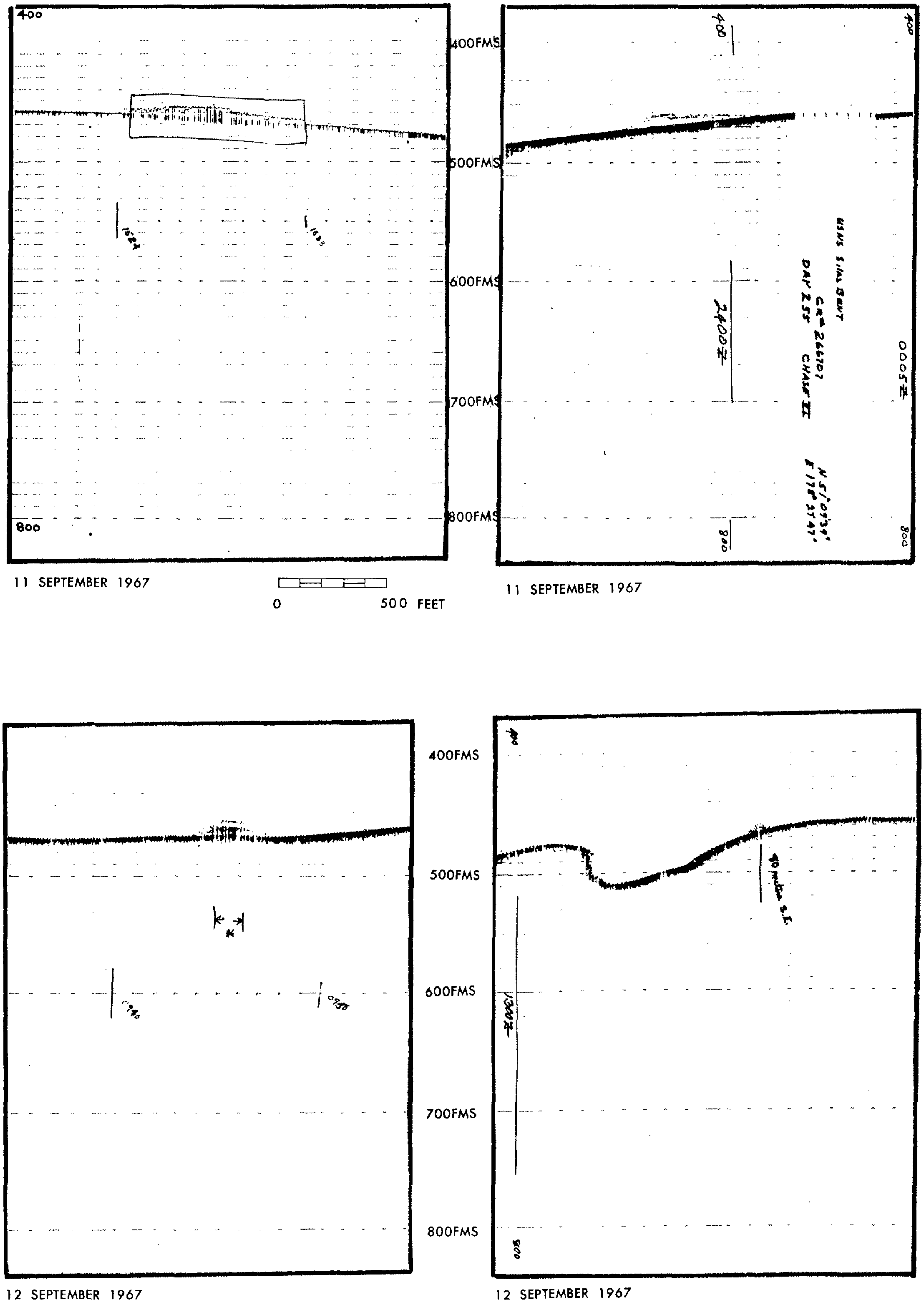


FIGURE 6. NARROW-BEAM SONAR CONTACTS OF STEVENSON HULK RECORDED DURING SEARCH PHASE

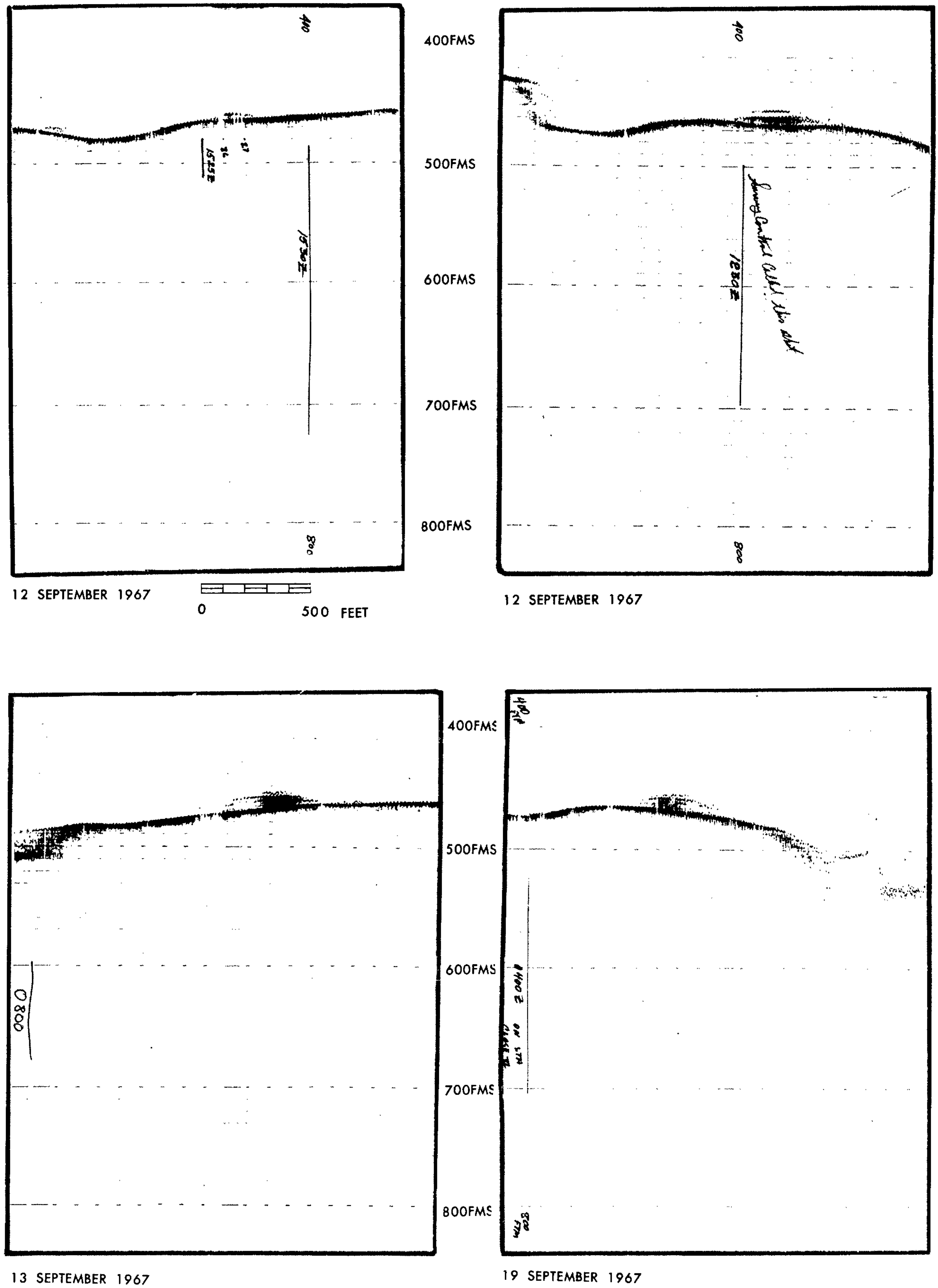
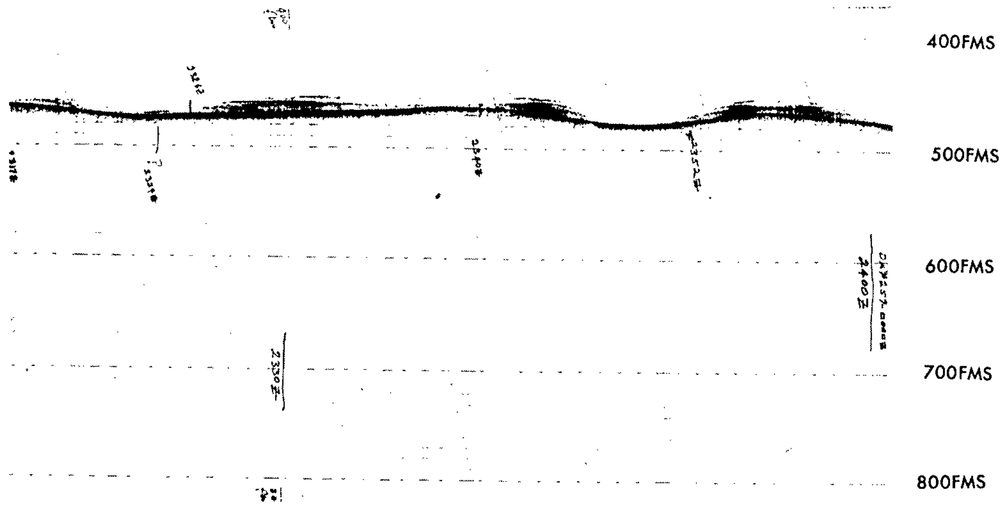


FIGURE 7. NARROW-BEAM SONAR CONTACTS OF STEVENSON HULK

VII. IDENTIFICATION

BENT recovered the current-meter arrays (Figure 8) on the afternoon of 12 September, and by 2000 local time the seas had moderated enough to permit camera drops. Although the original plan was to attach the magnetometer sensor to the cameras and trigger them from the surface, this procedure proved to be unnecessary because BENT could be positioned directly over the contact using the narrow-beam echo sounder. The first camera run was unsuccessful because of the failure of a delay mechanism designed to actuate the camera when it was properly positioned near the bottom. Although no pictures were taken, BENT was repeatedly positioned directly over the contact and wire angles indicated that the cameras were near their target (Figure 9). The delay unit was not used again after this first failure; instead the system was started operating before lowering. Two more camera runs were made on the morning of 13 September. On these two runs, BENT did not pass directly over the target; consequently, only bottom pictures were obtained. A fourth camera run around noon of 13 September could not have been more successful, and the excellent pictures obtained allowed positive identification of the hulk as that of STEVENSON.

In all, there are 29 pictures that can be identified as parts of a ship or other man made objects. Thirteen pictures can be positively identified and located as parts of a liberty ship. One picture, not included in the above, is obviously a life boat in a hold and two other pictures are obviously parts of holds. Just which hold or holds is uncertain. It is an established fact that three lifeboats were in hold number 2 and at least one in hold number 4. On return to Washington, D. C., Mr. Daugherty visited the James River Reserve Fleet to take pictures and make visual comparisons. Messrs. John S. Negrotto, Fleet Superintendent; John W. Grubb, Fleet Captain; and John L. West, Captain of the TD 23 were most patient and helpful. Their knowledge of liberty ships with their numerous variations solved serveral recognition problems. Two ships



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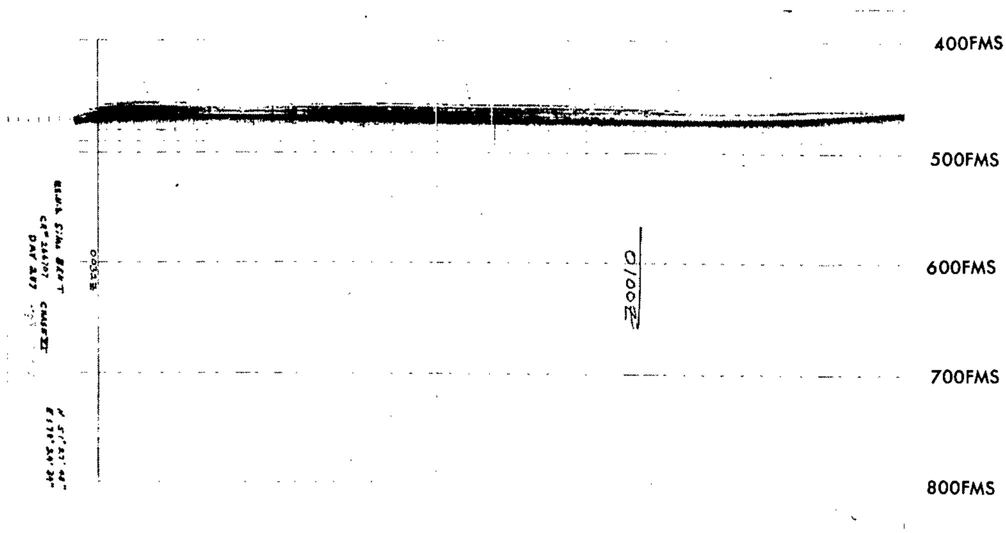

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FIGURE 8. NARROW-BEAM SONAR CONTACTS OF STEVENSON HULK DURING CAMERA RUNS

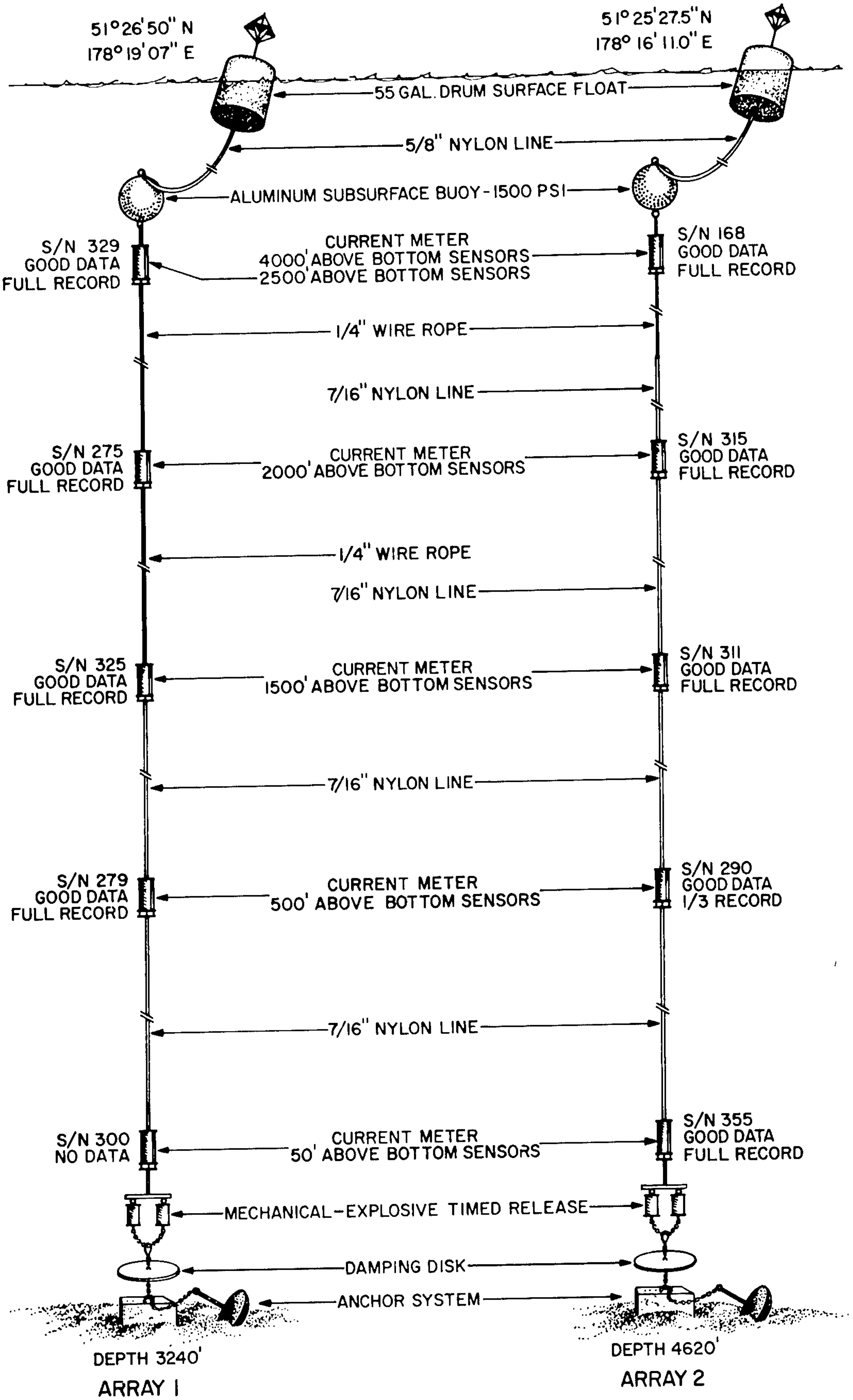


FIGURE 9. CURRENT METER ARRAYS

were selected as typical 5-hold, 3-mast liberty ships. WILLIAM FORD NICHOLS had no forward guntub, but did have an after gundeck and deckhouse similar to that of STEVENSON. JANE LONG was selected because she did have a forward guntub and associated parts that solved a number of questions.

Commander Prade was able to obtain a set of Polaroid pictures taken of STEVENSON prior to leaving Bangor. These have been very helpful in locating and associating various underwater camera pictures with parts of STEVENSON.

The comparisons have shown that the ship found by magnetometer, narrow-beam sonar, and camera is undoubtedly a liberty ship. Many of the comparisons when substantiated by the original STEVENSON pictures prove that identifiable situations positively occurred on STEVENSON. These comparisons are supported by pictures of the hulk photographed by BENT in the sink area. It is relatively clean and unfouled -- not as would have been expected of a ship sunk previously. Any other ship sunk even remotely close to this area would have had to go through at least one warm season and would have shown evidence of sessile animal growth. There was no growth evident in any of these pictures. No records exist of any sinkings, even wartime, in the immediate area. Lastly, the underwater pictures of STEVENSON show a weathered condition essentially the same as other liberty ships stored in one of the Reserve Fleets for 21 years. There can be no question -- STEVENSON has been located and identified and can be relocated in a very short time.

The pictures considered most specific to identification will be presented along with similar pictures of NICHOLS and LONG for comparison. No attempt was made to reproduce any of the Bremerton STEVENSON pictures.

Photo 5 is the first picture taken of STEVENSON with the underwater camera. This picture was made on a camera pass quarterly into the bow near the forward port chock. Photo 6 is a similar picture of JANE LONG. This same area was previously identified on a liberty-hull cannery ship in Kodiak.

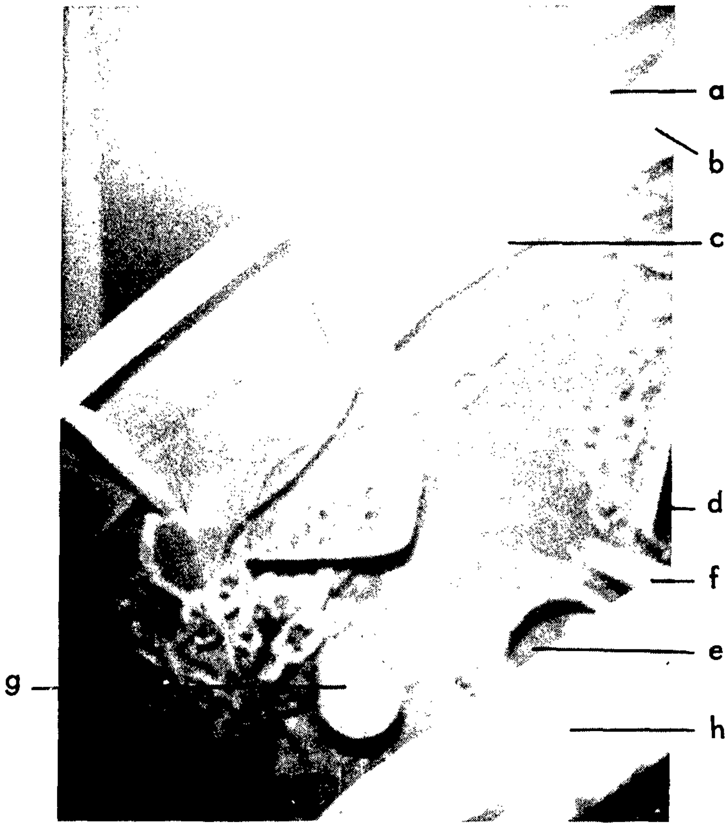


PHOTO 5, STEVENSON PORT BOW

PHOTO 6, LONG PORT BOW

a. Forward port side freeing port
b. Forward port chock single vertical roller
c. Forward port chock double vertical roller
d. Forward trunk hatch
e. Hawse pipe
f. Support stanchion for forward gun gundeck
g. Bitt for forward port chock
h. Side of gun tub (only shown in Picture 5)

Direct comparisons and identifications are possible of the forward open and closed port chocks with their typical vertical rollers, the bulwark, the freeing port in the bulwark, the forward trunk leading to the bosun locker and the chain locker, the port hawse pipe, the forward port bitt, and a stanchion supporting the forward gundeck. Item h. in Photo 5 (STEVENSON) shows the side of the forward gundeck. There is a great mass of anchor chain, part of which was used in the towing operation.

Two more pictures registered near the bow before the camera moved off the ship. One of these is the gun mount base on the forward gundeck, and the other is basically the hatch and trunk leading to the forward ammunition storage. This picture will be associated with later pictures. The camera then moved off the ship or too high for proper light transmission. The next photograph was triggered approximately 2 minutes and 48 seconds later as the camera was approaching the ship from the port side near the after-deckhouse. The next 6 pictures move progressively forward and midship over a period of 1 minute and 24 seconds. The camera continued to move inboard over the port after-guntub ng and guntub. Forward and below the guntub, the stern warping winch could be seen on the main deck, Photo 9. This winch is oriented athwartship with a gypsy head on each side. The guntub picture can be compared with Photo 7, Photo 8, and Photo 10 in which the port gypsy head leads directly aft under the port after-guntub to the port stern-chocks. Photo 10 was taken aboard NICHOLS.

The port after-guntub had been removed from NICHOLS, but everything else was clearly related to Photo 7 and Photo 9 of STEVENSON. Photo 10 was selected for comparison because it not only identifies the components of the guntub picture, Photo 9, but also leads into the next picture in the series.

The number 5 hold is immediately forward of the stern warping winch. The after port corner of the hold can be seen aboard NICHOLS in Photo 10,

PHOTO 7, STEVENSON PORT AFTER PASSAGE AND DECKHOUSE

a. Closed after vertical roller chock, portside
b. Wire rope, after tow
c. After passage, along side after deck house, portside
d. Bulwark
e. Handrail on side after deck-house
f. Bulkhead after deckhouse
g. Watertight after deckhouse door
h. Typical obtuse bulkhead angle of Liberty after deckhouse

PHOTO 8, NICHOLS PORT AFTER PASSAGE AND DECKHOUSE

a. After closed and open vertical roller chocks and freeing port
b. Gun deck wing for port after gun tub
c. After passage portside
d. Bulwark
e. Gypsy head, portside, steam warping winch
f. Stanchion supporting after gun deck
g. After deck house bulkhead
h. Stanchion supporting after gun deck
i. Shaft from steam winch

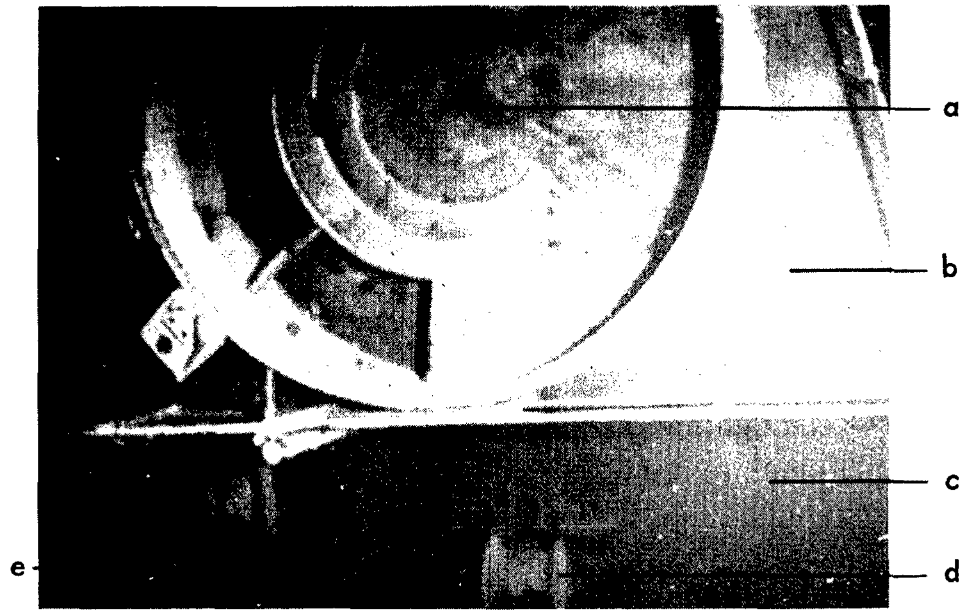


PHOTO 9, STEVENSON PORT AFTER GUN DECK

a. Port after gun tub
b. Gun tub deck and portwing over port passage along after deck house
c. After port passage and main deck
d. Port gypsy head to stern warping winch (steam). Gypsy head directly in line with after chock and freeing port
e. Stern warping winch runs athwartship with gypsy head to each side

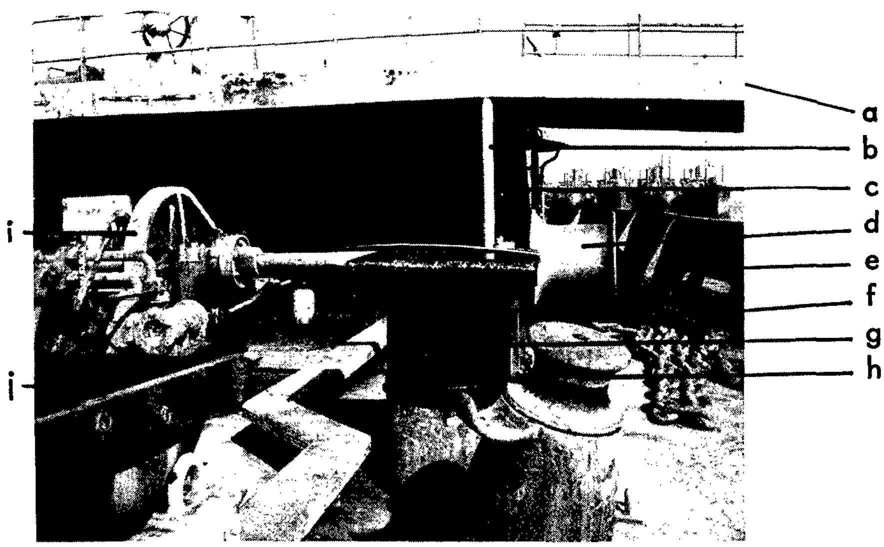


PHOTO 10, NICHOLS PORT AFTER GUN DECK

a. Gun tub deck and port wing over port passage along after deckhouse
b. Stanchion supporting after gun deck
c. After deckhouse
d. Port gypsy head, leads directly aft to after chocks, and freeing port
e. Bulwark
f. After port passage main deck
g. Ventilator, after port corner numbers hold
h. Fairlead to chock and gypsy head
i. Warping winch
j. Hatch, number 5 hold

item j., and near the corner of the hold are a ventilator, item g., and a fairlead item h. Photo 11 of STEVENSON shows these items in identical positions, a ventilator (item a) and a fairlead (item c). Hold number 5 is free of any hatch cover and appears to be loaded with a maze of different shapes and sizes, none of which are recognizable because of a decrease in light as the camera is being raised. In the next picture, the camera has moved from the after port corner of hold number 5 to a position almost directly over the hold and moving forward. This picture can be identified in series sequence and in configuration, but will not be reproduced.

In Photo 12 of STEVENSON, the camera is moving forward and upward. It is over the lead edge of the number 5 hold and centered over the afterstay of the aftermast. This stay attaches near the forward edge of the hatch combing between two cargo winches. These winches are characterized by their central drums and two gypsy heads on each side of the drum as shown in STEVENSON, Photo 12, items f. and g. and NICHOLS, Photo 13, item f. The mast table with its watertight doors and ventilators can be seen in Photo 12, and is readily compared with that of the NICHOLS in Photo 13.

As the camera moved forward and up it passed over the crosstree of the aftermast with its jumbo boom secured in an upright position. Photo 14 shows the camera approaching the aftermast from above and rising. The port side underway boom cradle collars are open. The jumbo boom seems to be broken in Photo 14, but this appearance is due to a shadow. The lower portions of the mast assembly recede into the background. Photo 15 of STEVENSON (prior to departure, Bangor) presents the identical mast for comparison. It should be noted that in this picture we are looking aft and the jumbo boom is clearly seen. STEVENSON was unlike NICHOLS in that both after cargo booms had been removed and were stored on the deck, starboard of number 5 hold. Photo 14 shows the port shrouds hanging free. This condition existed before STEVENSON departed Bangor.

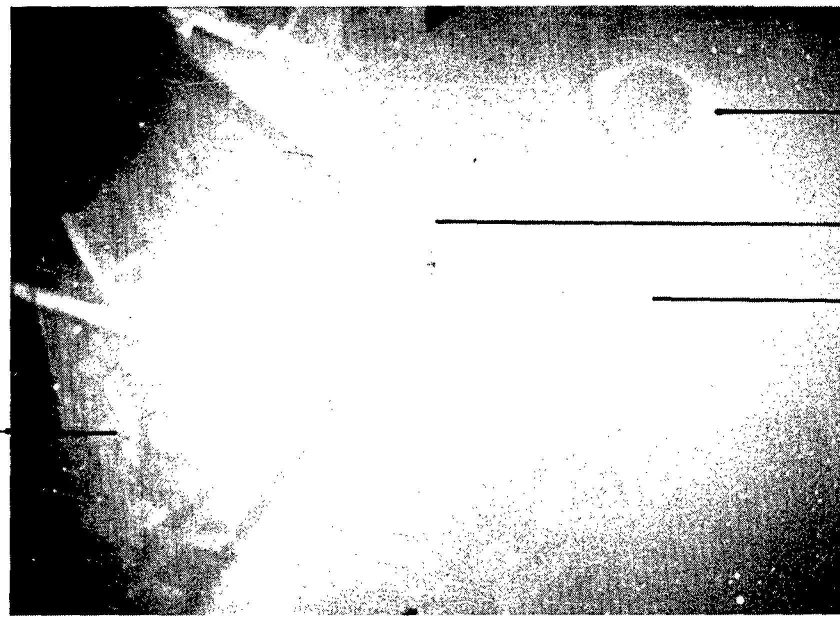


PHOTO 11, STEVENSON NUMBER 5 HOLD

a. Ventilator, after port corner Number 5 hatch
b. Number 5 hatch combing
c. Fair lead to gypsy head
d. Number 5 hold loaded with junk

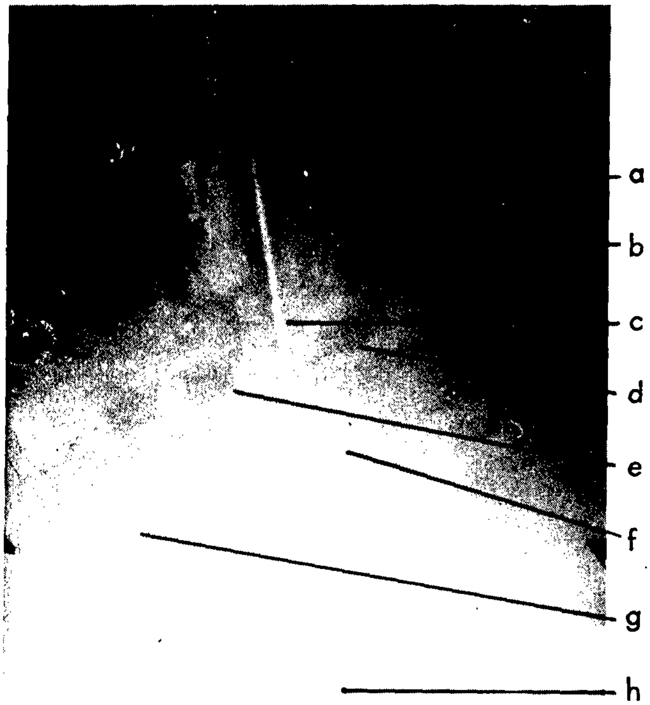


PHOTO 12, STEVENSON AFTERMAST MAST TABLE

a. After mast (between holds 4 and 5)
b. Ventilator, starboard, on top of mast table
c. After stay, after mast
d. Starboard watertight bulkhead door, mast table
e. After mast, mast table
f. Starboard cargo winch
g. Port cargo winch
h. Hold number 5

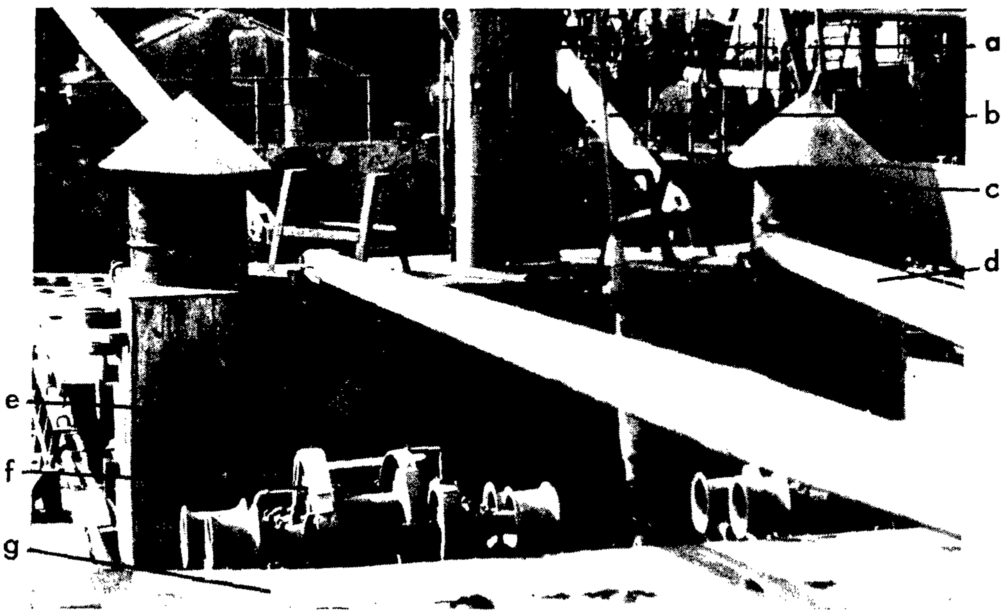


PHOTO 13, NICHOLS AFTERMAST MAST TABLE

a. After mast
b. After stay
c. Starboard Ventilator
d. Boom, cargo
e. Watertight, bulkhead door
f. Port cargo winch
g. Number 5 hatch

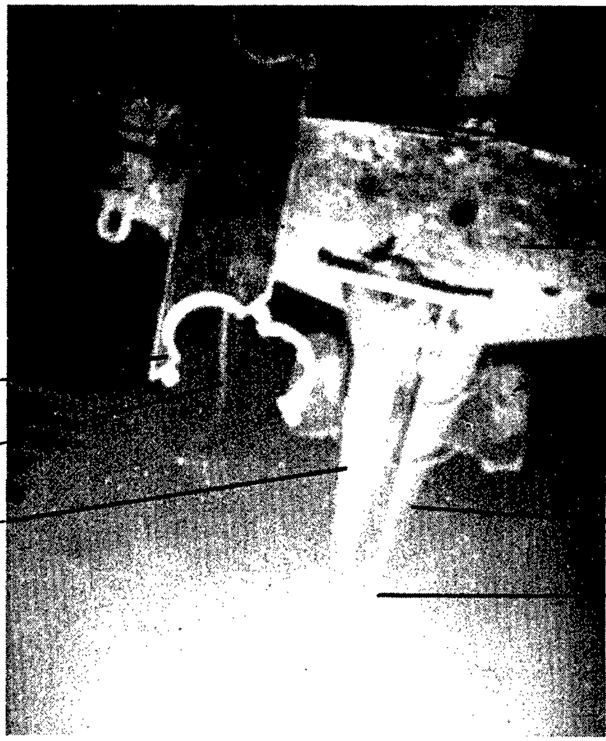


PHOTO 14, STEVENSON
AFTERMAST CROSSTREE

a. Jumbo boom in vertical position
b. Shadow on jumbo boom - not a break
c. Crosstree
d. Cargo light bracket
e. Aftermast
f. After stay
g. Cargo boom collars for vertical position
h. Port shrouds - hanging free
i. Telescoping boom

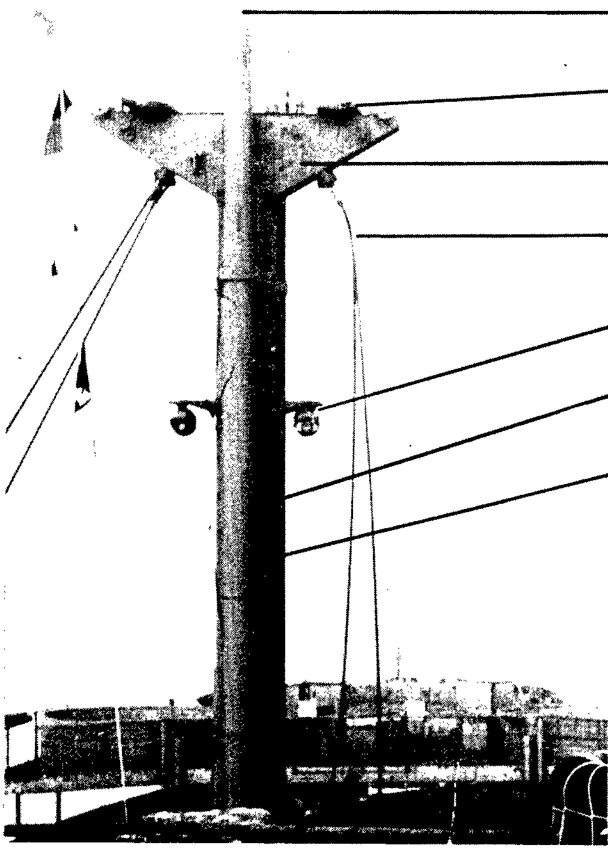


PHOTO 15, STEVENSON (AFLOAT)
AFTERMAST CROSSTREE

a. Jumbo boom
b. Cargo Boom collar
c. Crosstree
d. Port shrouds
e. Cargo light
f. Aftermast
g. Ladder

The slow movement and control of BENT are exhibited in this series of pictures taken over a period of 1 minutes and 24 seconds. This is pointed up very strongly in the last picture of the series which shows the starboard forward boom collar of the aftermast. This pictures, taken 12 seconds after the direct approach to the aftermast crosstree, indicates a movement of only 15 to 20 feet. After the above series, the camera was either raised too high for satisfactory light or was carried off the ship.

For one minute and 48 seconds or 9 frames there were no artifacts recorded. The camera then moved back over the ship for three pictures related to hatches and holds. The first is an indistinct hatch/hold combination with a shadow in the direction of camera movement that appears in the following frame as the bottom of a lifeboat, Photo 16. The lifeboat has sustained considerable damage to the keel and skin, but the pattern of the metal skin plates is evident as in Photo 17, a lifeboat found aboard LONG. The third picture is similar to the first of this series, but more distinct. The true 3-dimensional orientation of the plane of these pictures remains a mystery. They can be associated with hold/hatch number 2 or 4 because of the lifeboat. The cross members appearing in these pictures are considered to be horizontal battens on the hold cribbing rather than part of the wood and wire frames that held the regular hatch boards in place. This conforms to what appears to be a ladder at right angles to the cross members and to a lifeboat. This series of three pictures causes speculation as to the condition of the hulk and/or the attitude of the camera system.

A period of 9 to 10 minutes follows without pictures related to STEVENSON, then there are 16 pictures in sequence (3 minutes and 12 seconds). The second, third, and last four are the only distinct pictures of this series. The intervening pictures definitely record artifacts, but they are indistinguishable. The second pictures of the series shows two pieces of wire rope, approximately

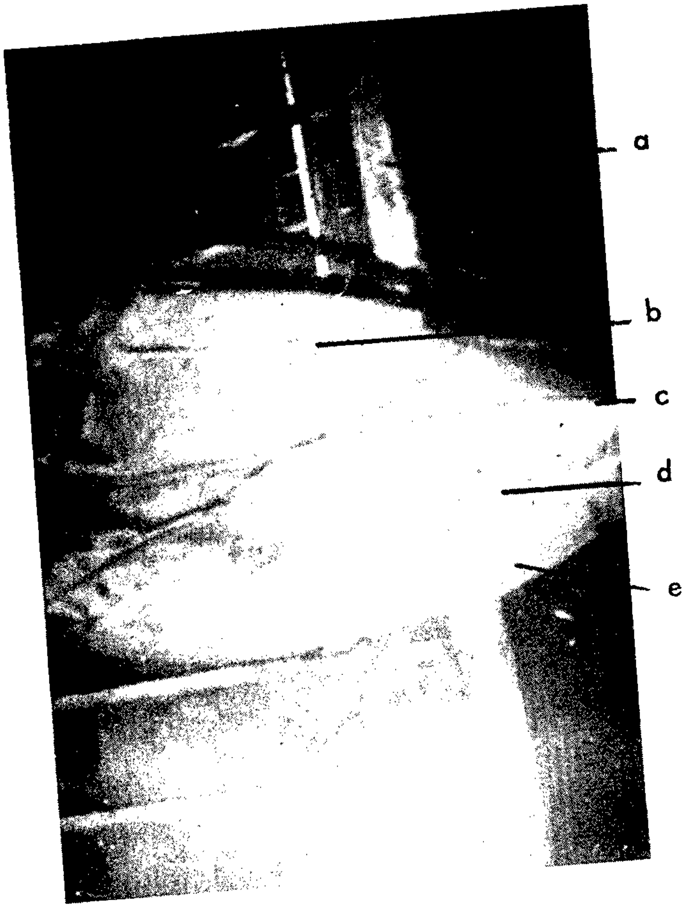


PHOTO 16,
STEVENSON LIFE BOAT

a. Hatch combing
b. Hand-hold strake
c. Keel
d. Metal plates, diagonal
e. Lifeboat

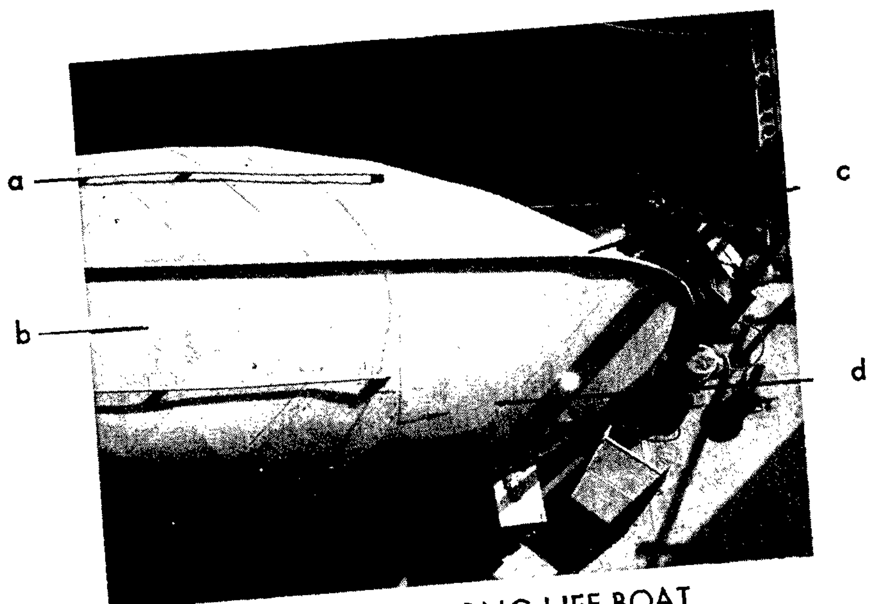


PHOTO 17, LONG LIFE BOAT

a. Hand-hold strake
b. Life-boat
c. Keel
d. Metal skin plates

the same in size as STEVENSON's mast shrouds. The third frame shows drooping pieces of wire rope that compare to the shrouds drooping on the portside of all three masts. Neither of these pictures can be positively identified.

This entire series of 16 frames seems to be moving forward along the starboard side of the ship. The four positively identified pictures ending this series completed the last camera run. The first of these, indistinct but readable, shows the camera approaching the starboard bulwark between number 1 hatch and the forward ammunition hatch and trunk. The bulwark and a triangular arrangement of a ventilator, fairlead, and bitt firmly establish the aspect and position of this picture. The camera, continuing its crab-like movement along the starboard side and angling toward the bow, next encounters the hatch and trunk assembly leading to the forward ammunition locker, Photo 18. This feature was mentioned previously in connection with the first three pictures and is shown here as Photo 19. The comparable location and structure on JANE LONG is shown in Photo 20. Photo 18 shows the same triangular arrangement of ventilator, fairlead, and bitt as in the discussion of the previous picture, which was too indistinct to print. This arrangement is mirrored on the portside in Photo 21, NICHOLS. JANE LONG's forward gundeck ammunition locker complex is equipped similar to STEVENSON and is presented here in Photo 20 for comparison. Considerable individual variation was noted in ships stored in the James River Reserve Fleet with respect to this complex; however, the components are functionally and spatially the same. The ribbon-like artifact extending aft along the forward gundeck and between the uprights over the ammunition hatch is a boom that was installed by Underwater Systems Incorporated, for use with their buoyed sensors. The small end of this boom was passed through a hole in the afterplate of the supports over the forward ammunition trunk, Photo 20, item h. This is readily identified by the link bank terminating the aft extending portion of the boom, Photo 18, item j, and Photo 19, item a. The boom extending from the forward gundeck out over the bow is shown in STEVENSON prior to departure Bangor, Photo 22.

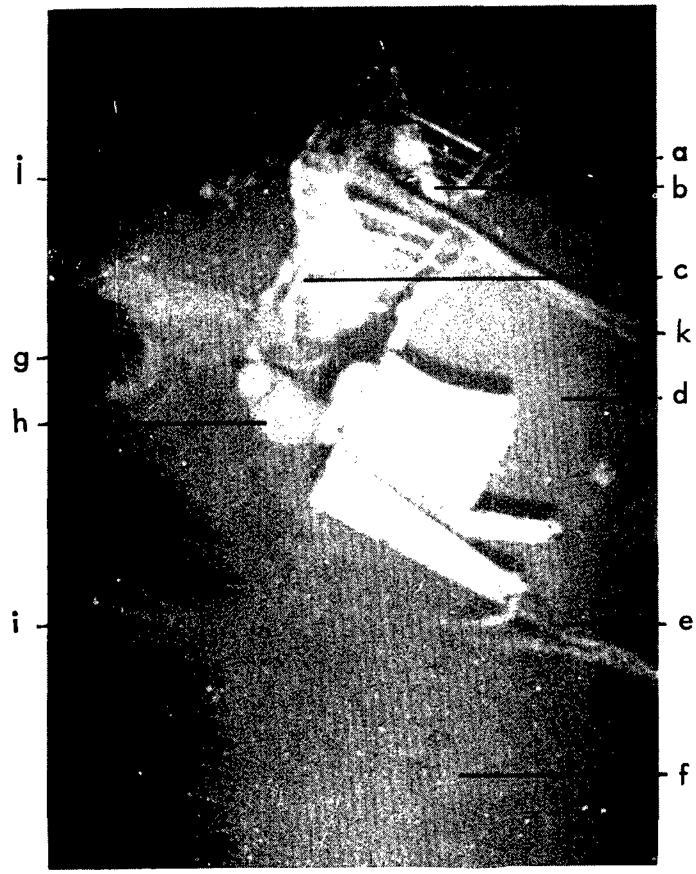


PHOTO 18, STEVENSON
FORWARD BOOM CRADLE

a. After hand rail
b. Davit socket
c. Boom cradle
d. Forward gun deck
e. Ladder gun deck to main deck
f. Main deck
g.. Ventilator, near hatch
h. Fairlead
i. Bitt
j. Linkband
k. Boom

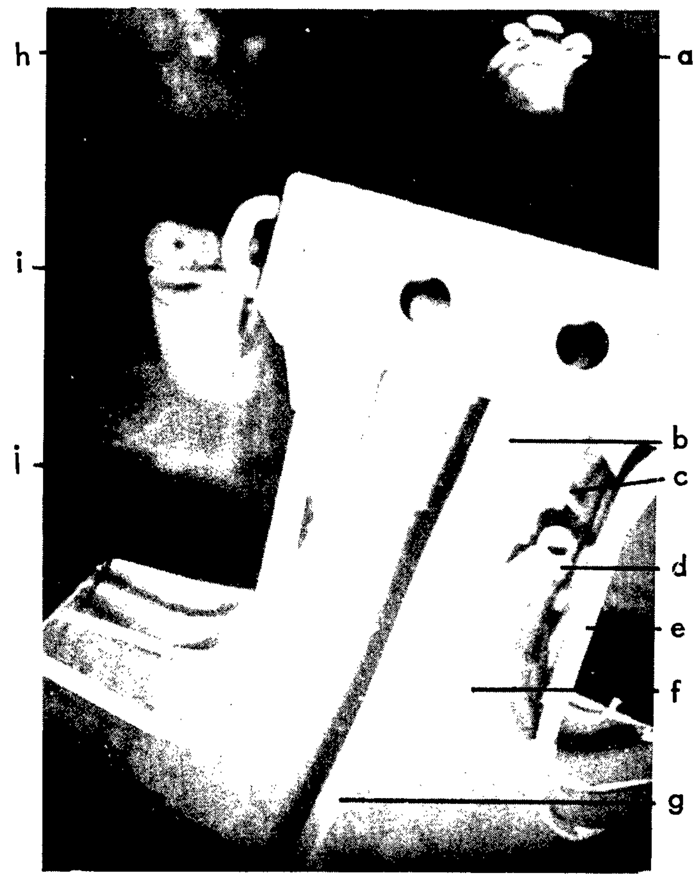


PHOTO 19, STEVENSON
FORWARD BOOM CRADLE

a. Linkband
b. Hatch, ammunition
c. Dog, hatch
d. Davit cup or socket
e. Handrail
f. Forward gun deck
g. Boom
h. Ventilator
i. Fairlead
j. Main deck

PHOTO 20, LONG FORWARD BOOM CRADLE

a. Davit
b. Plate with 2 holes
c. Handrail
d. Boomcradle
e. Davit socket or cup
f. Hatch
g. Dog, hatch
h. Hole in after plate

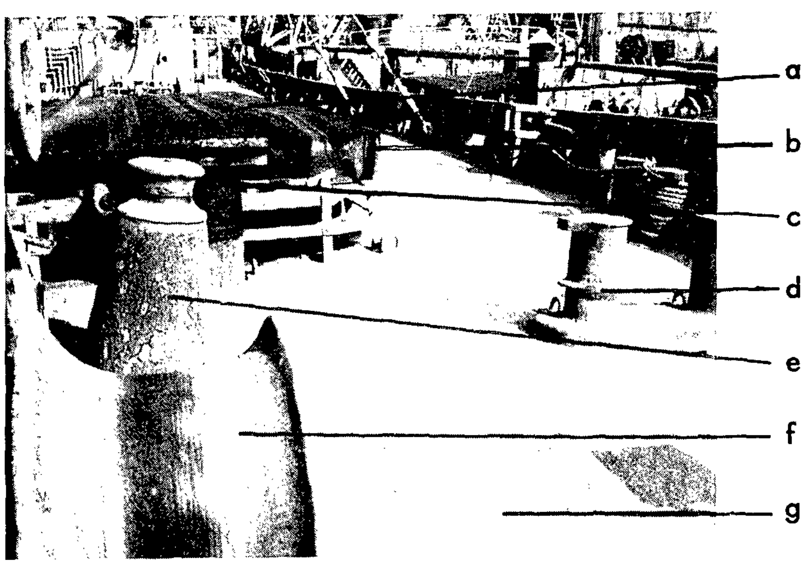


PHOTO 21, NICHOLS VENTILATOR, FAIRLEAD, BITT

a. Number 1 Hatch
b. Hatch combing
c. Ventilator
d. Bitt
e. Fairlead
f. Gypsyhead
g. Main deck portside

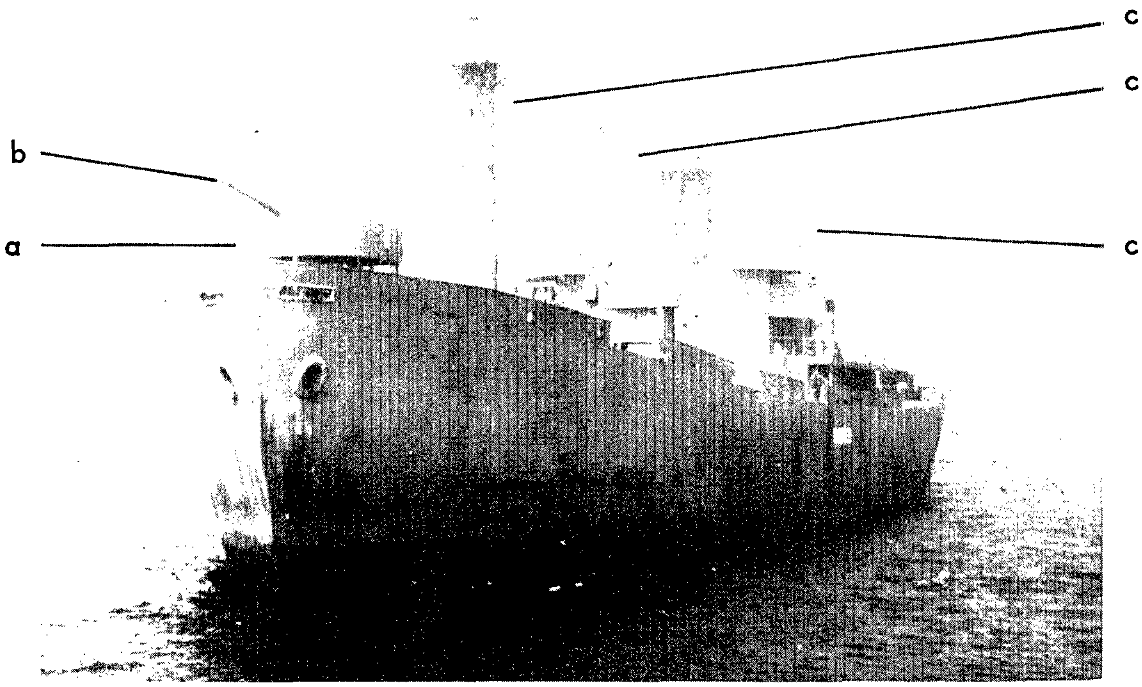


PHOTO 22, STEVENSON UNDER TOW

a. Forward gun deck
b. Boom placed across forward gun deck
c. Port shrouds hanging loose

This boom appearing ribbonlike was crushed by water pressure, but this may have been triggered by the impact with the bottom at an estimated speed of 15 knots. This one item offers positive proof that STEVENSON is located.

It seems anticlimactic to continue with examples and comparisons, but it is fitting to carry this sequence of photographs full course. The forward gundeck is next in this sequence of pictures and is shown in rather shadowy form outlined by the port and starboard bow bulwarks in Photo 23. The final picture is not shown because it is too faint to reproduce; however, it is very evident that it is the bow. Strangely, a cycle has been completed, the camera was moved over the ship by way of the bow and departed the same way.

VIII. DETONATION OPERATIONS

BENT arrived in Adak on 14 September 1967. After the pictures of the hulk were developed, the decision was made to bomb the hulk as the safest approach. A plan was developed to obtain additional pictures of the hulk, if necessary, followed by implanting a marker buoy to serve as a bombing target for P-3 aircraft.

Commander Nathaniel H. Prade, Ordnance Officer, Weapons Station, Concord, California, modified twenty-four 2000 pound bombs (Reference 2) for detonation by pressure. Modifications were made to P-3 aircraft for the acceptance of suitable bomb racks and release mechanisms. These bombs were designed to be activated by pressure at a depth of 2500 feet, but a time delay mechanism would allow them to sink to the bottom before exploding. Commander Prade selected these bombs on the basis that they would provide sufficient overpressure for the necessary duration to trigger the SUS bombs if dropped near enough to STEVENSON. Navy Laboratories conducted model tests which substantiated that these bombs would provide the proper overpressure.

The APL acoustical positioning system was installed aboard BENT and a transponder installed on the camera sled for use with this system. The camera

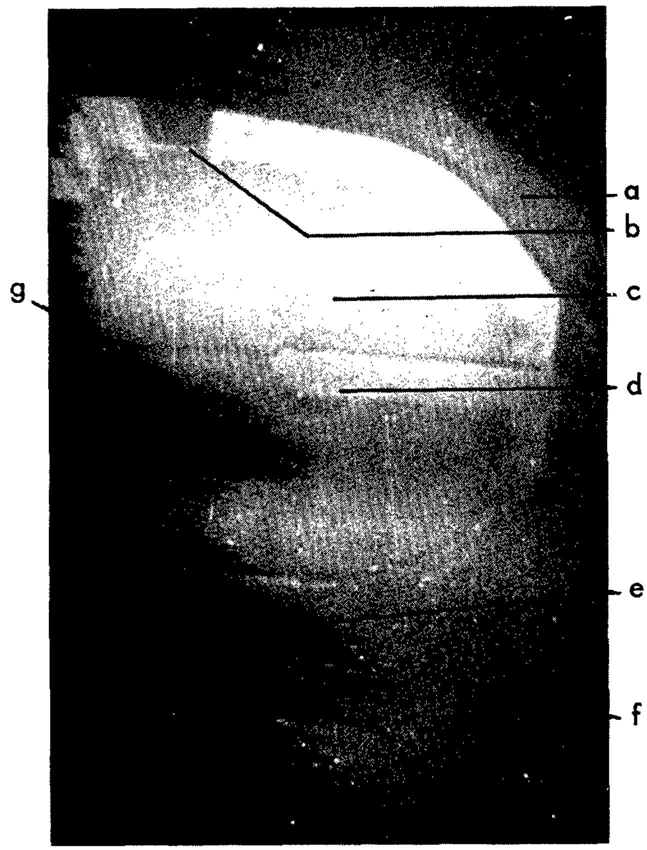


PHOTO 23, STEVENSON FORWARD GUN DECK

a. Bulwark, Port Bow
b. Ladder down to main deck
c. Gun deck
d. Gunmount
e. Main deck
f. Bulwark Starboard bow
g. Boom (placed across gun deck)

system was attached to the magnetometer cable for controlled triggering. A separate transponder was provided for positioning the marker-target buoy which was being readied. Final preparations were completed for the detonation phase by 17 September. A storm with very high winds had been in the area since 14 September, but satisfactory weather was indicated by U. S. Weather Bureau experts aboard BENT, and the ship put to sea at noon on 17 September.

CTG-93 informed the group that additional pictures of the hulk were not required and to proceed with the implantation of the marker-target buoy. USS BAUER, Captain Betzel's flagship, vectored BENT onto the target with her very excellent sonar contact. This saved considerable time searching for the familiar narrow-beam contact (Figure 11). The initial request, by the liaison team, for a ship with SQS-23 sonar was certainly substantiated by this assist. In addition, the original search time might have been shortened by several days if an SQS-23 had been available at the start of the magnetometer sweeps. Once over the hulk, as confirmed by a narrow-beam sonar contact, we proceeded to lower the marker-target anchor system (Figure 10). Two Mark 59 SUS bombs, deactivated except for the diaphragms and the firing pins, were placed on the anchor chain, 5 and 10 feet above the anchoring clump. An APL transponder (Photo 24) was suspended by nylon line about 100 feet above the anchoring clump.

A 3/8-inch diameter wire rope was used in the array as support member to eliminate stretch as much as possible. The anchor and anchoring clump were lowered over the side and set on the bottom when the ship was directly over the hulk as evidenced by the narrow-beam sonar and the APL positioning system. The anchor system was raised until full tension was regained. The wire was stopped-off, cut, and tied into the buoy. When the ship was once more directly over the target, the buoy was released. It is estimated that the maximum scope radius was 280 feet and that the prevailing wind and near surface currents would maintain the buoy in a nearly constant position. Such a plant would not have

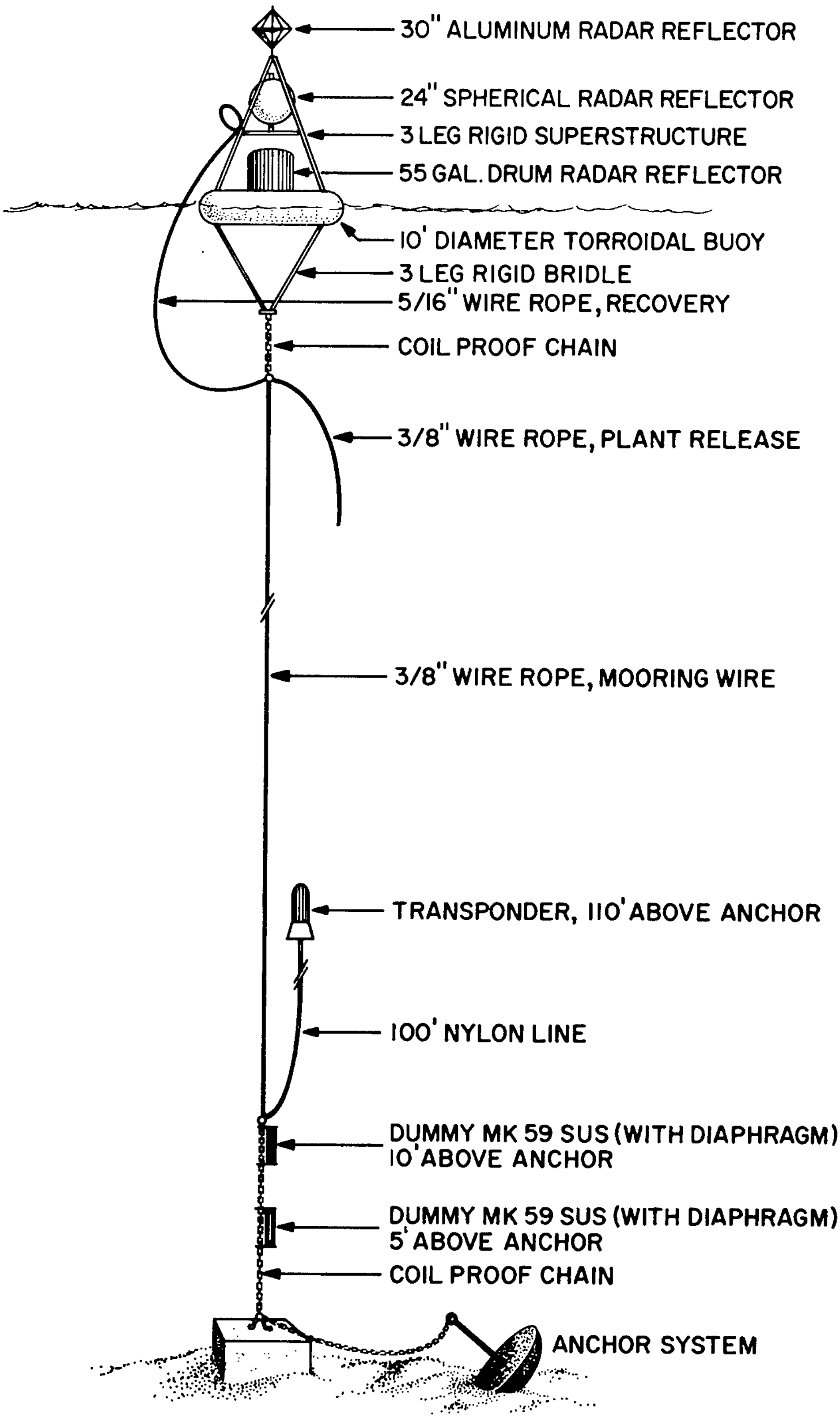
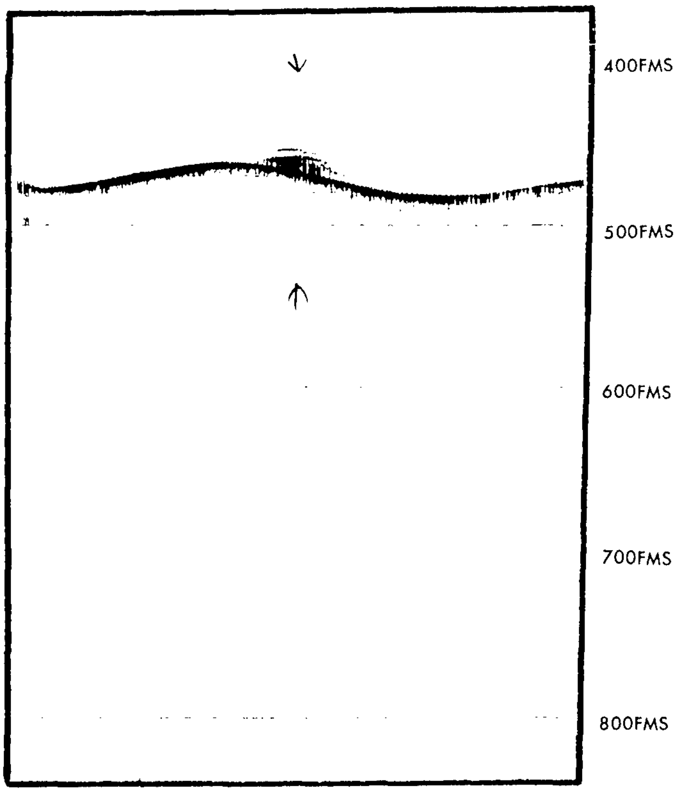
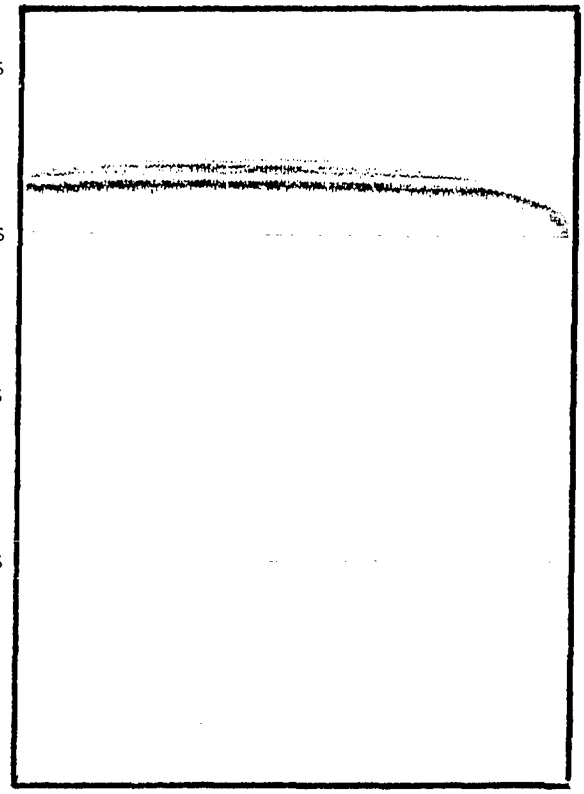


FIGURE 10. MARKER BUOY - BOMB TARGET



19 SEPTEMBER 1967



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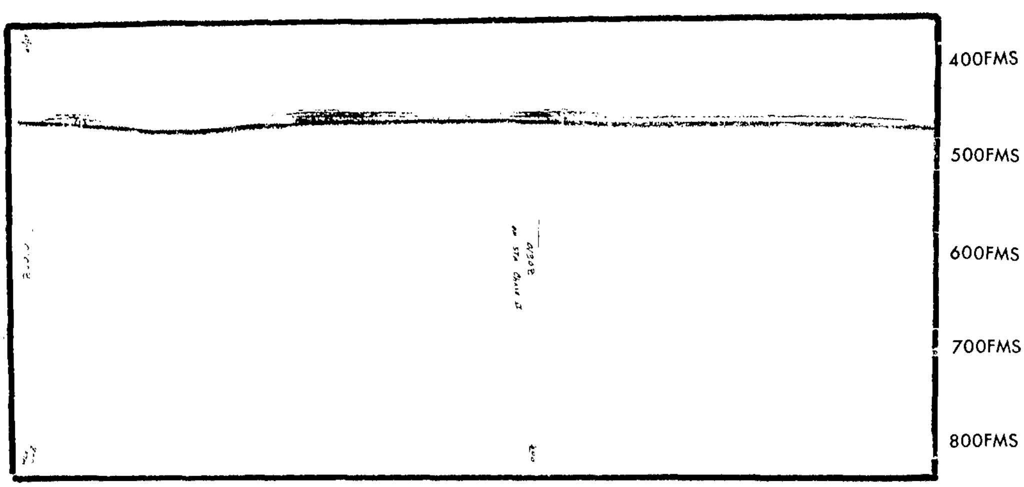

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FIGURE 11. NARROW-BEAM SONAR CONTACTS DURING RELOCATION FOR THE MARKER BUOY

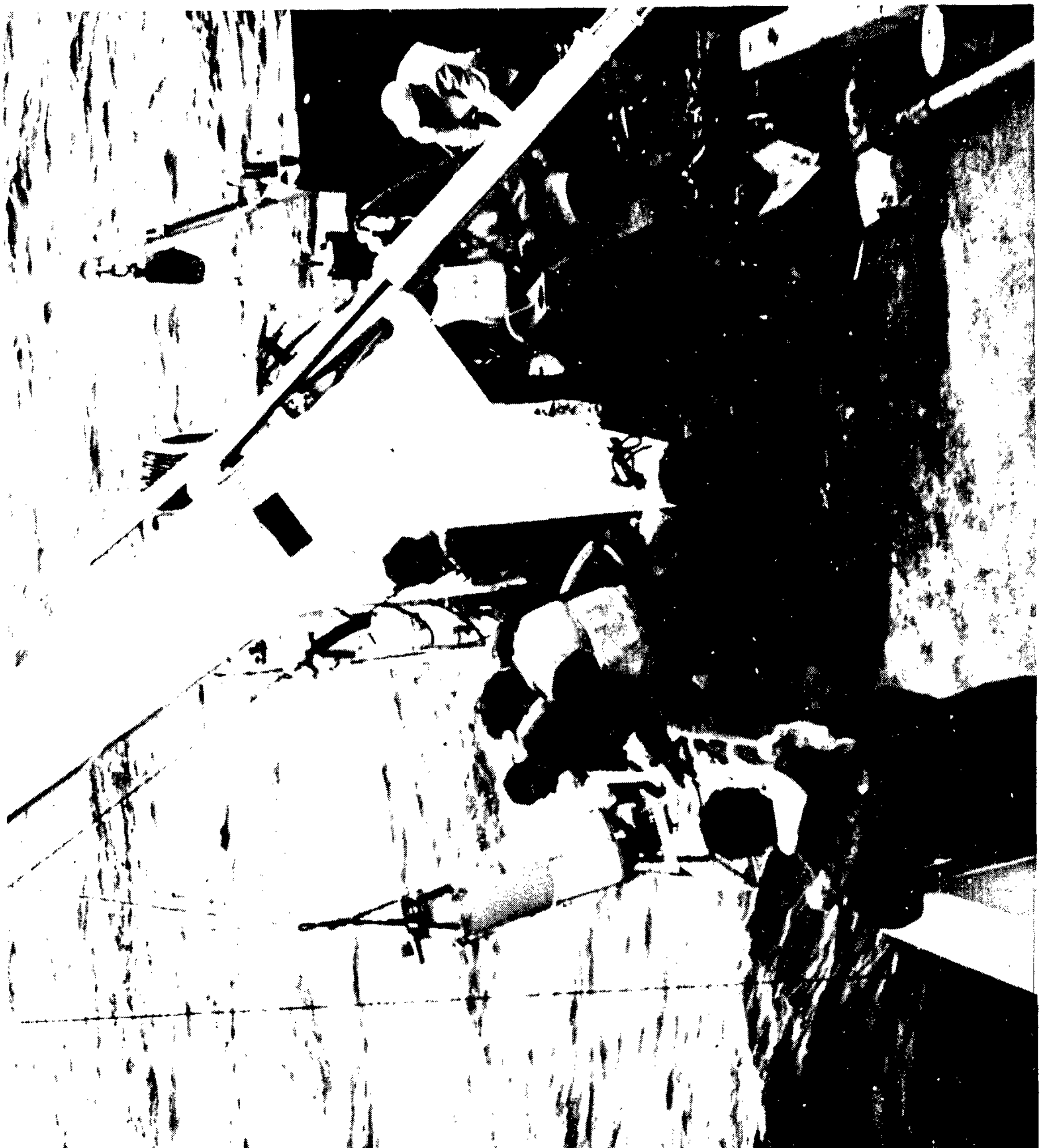

PHOTO 24, APL TRANSPONDER

been possible without the APL positioning system and the skill of Captain Savage. All of these skills and technical abilities were supported by the expert handling of the winch controls by ship's personnel.

On the morning of 19 September, the position of the buoy was established and the APL transponder was recalled acoustically. BENT moved away to a safe distance and bombs were dropped on the target, singly or in groups of 2 and 3. BAUER remained nearer the target and provided navigational information to the aircraft. All of the bombs detonated as planned, but the cargo aboard STEVENSON did not explode. The bombing runs were photographed from the air and, in some runs, the target and point of water impact were clearly visible. Sonabuoys dropped in the area recorded the detonations and were used to determine their positions.

After the last bomb had detonated, BENT moved in and recovered the marker-target buoy. As recovery of the buoy commenced, it became evident that the anchor was caught and on forced recovery a break occurred a few feet above the point of connection with the 10-foot piece of chain attached to the anchor clump (Figure 10). This placed the break 20 to 50 feet above the level of the anchor system. The SUS bombs were lost. Examination of the break indicated that the wire had been bent over a sharp edge and no evidence of a loop type kink existed. The weakest points in the system were the wire-clip formed eyes and in the 5/16-inch diameter recovery loop. The break should have occurred at one of these points had it not been for the sharp bend. All indications are that the anchor clump was directly alongside STEVENSON or perhaps on the deck of the ship. The operation was concluded and the task force returned to Adak.

IX. OPERATIONAL DEBRIEFING FOR CTF-93

A debriefing was held in Admiral White's Office on 22 September. Those attending included Admiral White, Captain Tickle, Captain Betzel, Mr. Daugherty, Captain Savage, Commander Prade, Lieutenant Kuhn, and the Staff PIO. Captain Betzel reviewed the entire operation briefly, but completely. Captain Savage covered the capabilities of BENT and the navigation including the assist by Dr. Murphy and the APL positioning system. Captain Savage also praised the work of the magnetics team in their seemingly impossible task of overcoming the problems of the vehicle, wire, and signal strength. He also discussed the positioning of the marker-target buoy and how accurately he felt it was planted.

Mr. Daugherty discussed the location and identification of the hulk. In addition, he reviewed the overall operation including planning, background data collection, search and bombing phases emphasizing the continued high degree of cooperation and coordination maintained throughout CHASE VI operations. He stressed the importance of the tightly knit team from Admiral White down through the various groups working together, indicating that it was a very fortuitous happening that brought together this particular combination of men and instruments. Mr. Daugherty and Captain Savage then teamed to review the identification based on the photographs.

Commander Prade discussed the bombing operation, exhibiting a plot of the 24 drops relative to the marker-target buoy, the travel of the bombs underwater, the position of the ship relative to the marker-target buoy, and the number of bombs detonating within the required over-pressure range. While several bombs exploded within this range, 250 feet, 4 to 7 may have exploded near enough, 60 feet, to trigger SUS bombs with deteriorated diaphragms (Reference 2). He also spoke of the excellent approach to the problem by the bombing squadron under Commander Levitz. Photographic evidence indicates that the hulk may be damaged and part of the cargo dispersed which could explain why the bombing attempts were unsuccessful. If the SUS bombs were dislodged by a distance of 5 feet from their position and exploded, the cargo would not be detonated. During the bombing attempts, the sona-buoys could not distinguish between SUS bomb detonation and the explosion of the dropped bombs.

Admiral White thanked the group for their presentation, complimented everyone on a job well done, and stated that STEVENSON could not longer be considered dangerous to accidental detonation, and the operation was concluded.

X. CONCLUSIONS

The Navy has engaged in four major search operations in recent years, all related to national emergencies. These have occurred at the rate of one every 13 months, from the THRESHER tragedy in April 1963 to CHASE VI in August 1967. The well planned, successful CHASE VI SALVOPS stimulates several conclusions:

(1) The Navy has become increasingly more efficient and knowledgeable of search philosophy and methods.

(2) Admiral White and the CHASE VI planning group were able to draw on past experiences to develop a search, identification, and disposition plan designed to approach the operation calmly and purposefully yet keeping the cost to a minimum.

(3) It was possible to conduct a highly successful operation with equipment and instruments available on BENT, from somewhere else in NAVOCEANO system, from other Navy laboratories, or relatively easy to procure from groups holding Navy contracts.

(4) Previous emergencies such as the bomb search off Palomeres, Spain, and many hydrographic and oceanographic operations had taught us the great value of highly sophisticated electronic positioning systems, such as DECCA HI-FIX and RAYDIST. Procurement and installation of such a system was among the very first recommendation of Messrs. Daugherty and

Cheeseman as members of Admiral White's planning group. The cost of such a system was of prime consideration, but the importance of the planning groups evaluation of every facet was accentuated. The presence of Loran-C, the possibility of an excellent norrowbeam sonar, the fact of outstanding ship control, and the consideration of the well analyzed priority sink area of four square miles lead to the conclusion that the location of the hulk might well be accomplished without a sophisticated navigation system. We proved this to be true, substantiating our faith in our analysis and planning.

(5) The Applied Physics Laboratories 3-dimensional transponder positioning system proved to be a welcome adjunct to the very delicate and exacting marker-target buoy planting, by refining the vertical position of the anchoring clump relative to the ship.

(6) A ship equipped with an ASW SQS-23 sonar was one of the very first search items requested by NAVOCEANO. This was based on the knowledge of its operational capabilities and characteristics as compared to its predecessors, the family of converted RDT SQS-4 sonars. USS BERRY, equipped with one of the RDT sonars, was totally unsuccessful when considered in the hindsight provided by the final known hulk position. USS BAUER, SQS-23 equipped and provided with the hulk position, was able to make contact immediately on approaching within her ranging capability, to ascertain STEVENSON altitude confirming BENT's prior determination, and to guide BENT directly over the hulk without the usual preliminary searching. With the knowledge of the "Original" and "Revised" sink positions and other evaluations establishing the priority 4 square mile search areas, it can be concluded that an SQS-23 equipped ship could have decreased the 6-day location time by better than 50 percent and in the specific case of CHASE VI could have provided a firm contact in the preliminary search phase. This would have provided the operational team with a firm identification starting point in the event that the magnetometer had not become operational.

(7) We must continue to improve our search capability so that future searches require even less time. Equipment is available today to meet this requirement including deep-towed magnetometers, ocean bottom scanning sonar, television, and camera systems. Navigational systems must be available such as transponder systems and underwater acoustical systems for deployment to areas lacking a navigational capability. The problem is not one of a lack of equipment -- but one of organization and being ready to deploy the necessary equipment quickly in time of emergency.

XI. RECOMMENDATIONS

It is recommended that the Naval Oceanographic Office be assigned the technical responsibility for conducting future search operations within the guidelines of proposed OPNAV Instruction 4740.___. NAVOCEANO's responsibilities should include:

(1) Formulating operational plans for searches.

(2) Developing and procuring systems to be used on ships under NAVOCEANO technical direction.

(3) Maintaining liaison with other government organizations and private industry.

(4) Contracting through the Supervisor of Salvage equipment and personnel from private organizations to assist in search operations.

(5) Fabricating search systems for deep submersibles.

(6) Maintaining in semialert specially trained personnel and equipment to be immediately deployed for search operations.

(7) Conducting training of personnel in the use of search equipment in conjunction with Fleet and NAVOCEANO controlled ships.

(8) Formulating a branch to conduct planning and operations specifically for search and rescue.

(9) Developing a portable search system or systems, that can be readily deployed on any of several ships that NAVOCEANO has under its technical direction.

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CHASE VI SEARCH OPERATIONS, by F.M. Daugherty, Jr., Joseph A. Cheeseman, and Jerry C. Carroll, February 1968, 52 p., 11 figs., 24 photos, (SP-120), Reference p. 52.

A Reserve Fleet Liberty Ship, loaded with 2000 tons of obsolete explosives, scuttled intentionally south of the Aleutian Islands failed to detonate as planned. Ex-ROBERT L. STEVENSON was located in 6 days with a deep-towed magnetometer and identified by underwater photographs. Bombs were dropped in an unsuccessful attempt to blow the explosive cargo. Bomb to target pattern evaluation establishes the area as safe with no chance of accidental detonation.

1. Aleutian Islands
2. Scuttled ship
3. Deep-towed magnetometer search
4. Deep-towed magnetometer location
5. Identification, underwater camera

i. title: Chase VI Search Operations
ii. authors: F.M. Daugherty, Jr., J.A. Cheeseman, and J.C. Carroll
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11. SUPPLEMENTARY NOTES	12. SPONSORING MILITARY ACTIVITY
	U. S. Naval Oceanographic Office

13. ABSTRACT

On 10 August 1967, the Navy intentionally scuttled ROBERT LOUIS STEVENSON, (a World War II Liberty ship) near the Aleutian Islands. The hulk, loaded with 2000 tons of obsolete explosives, was set to explode at a depth of 4000 feet simulating a low-yield underwater nuclear explosion. Seismic signal data from this explosion would assist in the United States' program to develop the capability for detecting clandestine underwater nuclear explosions. Failing to sink immediately as planned, the ship drifted into shallow water and sank without exploding.

Moving quickly but with a well planned operation, the Navy proceeded to resolve the fourth major marine emergency in recent years. After searching the area for 6 days, NAVOCEANO's deep-towed magnetometer located the hulk on 11 September. NAVOCEANO personnel obtained underwater camera pictures identifying STEVENSON by using BENT's narrow-beam sonar to navigate and hold over the magnetometer contact. Aircraft from Adak, Alaska, dropped twenty-four 2000-pound bombs on the hulk but failed to detonate the cargo. Several of these bombs exploded close enough to the hulk to provide overpressure for the necessary duration to detonate the hydrostatic fuses aboard STEVENSON. The Navy notified the public of the exact location of CHASE VI and terminated the operation on the basis that the hulk could not be accidentally detonated.

14. KEY WORDS	LINK A		LINK B		LINK C	
	ROLE	WT	ROLE	WT	ROLE	WT
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